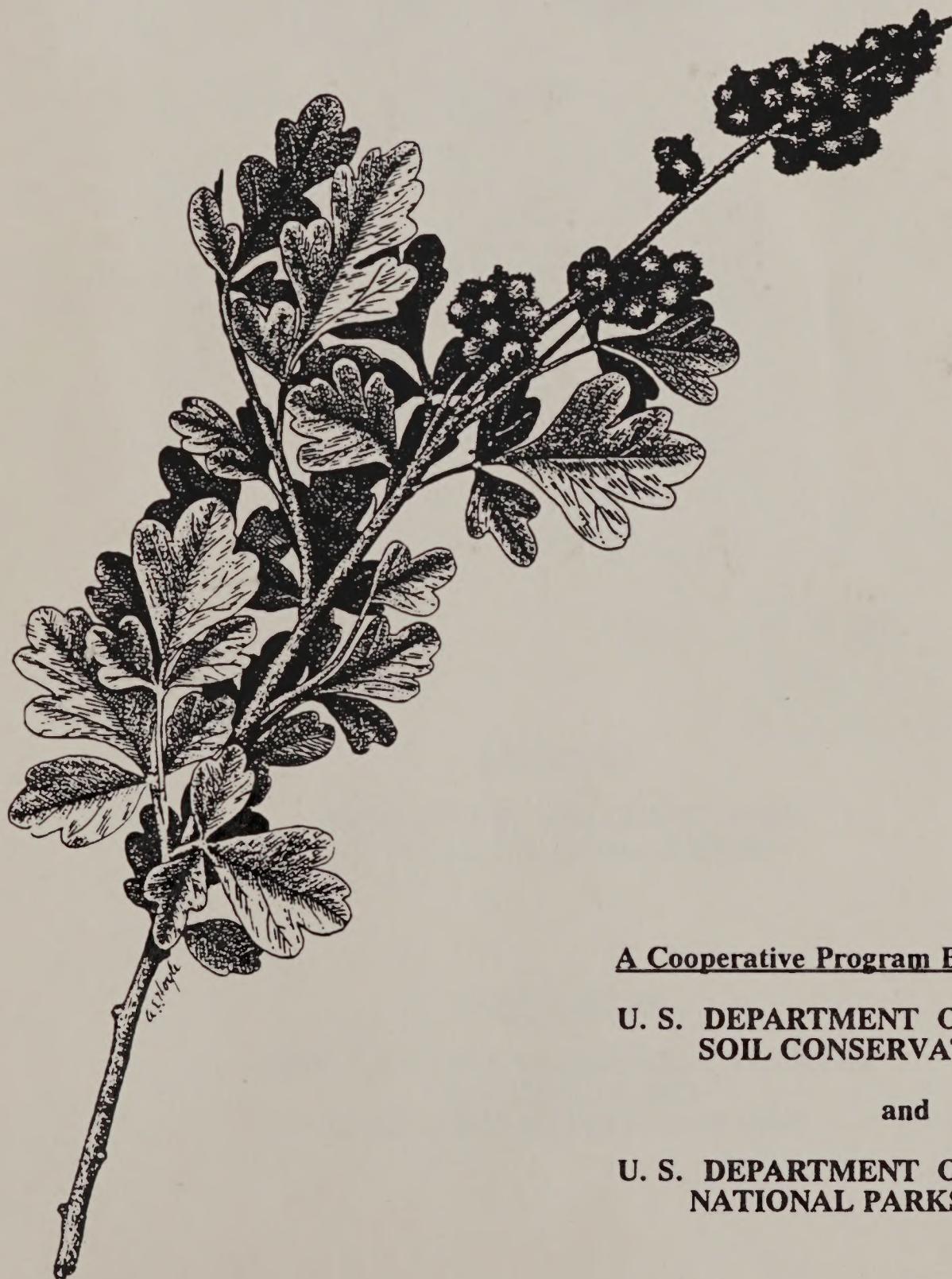


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NATIVE PLANT
PROPAGATION TECHNIQUES
FOR
NATIONAL PARKS



A Cooperative Program Between The:

**U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE**

and

**U. S. DEPARTMENT OF INTERIOR
NATIONAL PARKS SERVICE**

**United States
Department of
Agriculture**



NATIVE PLANT PROPAGATION TECHNIQUES FOR NATIONAL PARKS

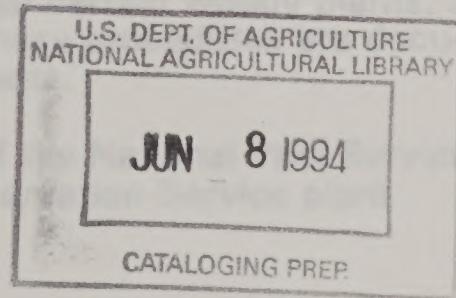
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SOIL CONSERVATION SERVICE**

AND

**U. S. DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE**

1993



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Acer circinatum Pursh

VINE MAPLE

BRIEF DESCRIPTION OF NATIVE HABITAT: (Collected at 2800 feet.) Associated vegetation: mixed conifer overstory. Occur at low to moderate elevations in Cascade range as understory (small tree) or in openings, cut-over clearings (as shrub).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seeds (samaras); vine maple, like most *Acers*, are difficult or impossible to root from cuttings.

SEED MATURITY DATE: End of August to early September: seed collected towards end of season may be harder to germinate, although viable.

NUMBER OF SEEDS PER POUND: Average 4,600 BUT seed generally left with samara intact.

PERCENT GERMINATION: Low (usually 10%-15%), even with stratification.

EASE OF COLLECTION: Hand collected

METHOD OF CLEANING: None: samaras are stratified and planted without separating seed.

STORAGE REQUIREMENTS: Recalcitrant seed: do not allow to dry out. Collect and store in moist medium, such as peat moss.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Unknown; seeds are normally placed directly into stratification.

PROPAGATION METHOD: From stratified seed, or seeded directly into flats left in lathhouse or cold frame over winter.

PRETREATMENT USED: Stratify at 35°-40°F for 6 months if not seeding directly.

METHOD OF GROWING: Germinate seed in flats; transplant to tubelings or one-gallon pots. Soil gathered from understory of vine maples may be used to inoculate seedlings with beneficial mycorrhiza, although satisfactory growth has been achieved using supplemental nutrients in lieu of soil inoculum. Maintained in lathhouse in one-gallon pots since 1991 at Corvallis, plants are due to be transplanted to 3-gallon pots in 1993. Shoots pruned back to half length in 1992.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Seed may enter deep dormancy or become non-viable if allowed to dry out.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: We have successfully transplanted bare-root seedlings at Corvallis in spring; fall transplanting as containerized stock is planned for 1995 at Mt. Rainier.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Literature review in progress as of May 1993.

Acer glabrum Torr.

ROCKY MOUNTAIN MAPLE
MOUNTAIN MAPLE

BRIEF DESCRIPTION OF NATIVE HABITAT: Primarily moist, wooded hillsides and ravine banks, often rocky soil conditions.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Variable, from August through early October possible

NUMBER OF SEED PER POUND: 13,000-14,000

PERCENT GERMINATION: Very limited PMC data; probably >25%.

EASE OF COLLECTION: Hand picking of samaras.

METHOD OF CLEANING: Cleaning simply involves hand rubbing or hammermilling of wings and blowing off of chaff by clipper or M2B.

STORAGE REQUIREMENTS: Drying of fresh seed to 10%-15% moisture content prior to storage @ 2°-5°C in sealed containers.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Literature states 1 to 2 years @ 2°-5°C in sealed containers. We seem to get good germination of dried seed stored at about 60°F in paper envelopes (if given the proper pretreatments).

PROPAGATION METHOD: Pretreatment and direct seeding in cone-tainers or fall field planting.

PRETREATMENT USED: We've had 25% germination in limited tests with 180-day warm stratification followed by 180-day cold stratification and cone-tainer seeding. We've also had good emergence of fall-seeded, field-planted groups but no germination data.

METHOD OF GROWING: In greenhouse in cone-tainers or in field. Commercial peat:perlite mix. Captan on seed and media during cold chill.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Bridger, MT Plant Materials Center

MOUNTAIN MAPLE

DOUGLAS'S MAPLE

BRIEF DESCRIPTION OF NATIVE HABITAT: Rocky slopes, understory or open canopy; ranges up to higher elevations than vine maple (collected at 6600 ft. at Crater Lake, 3900 ft. at Mt. Rainier).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed (samaras)

SEED MATURITY DATE: August - September (seed retained on branches for weeks).

NUMBER OF SEED PER POUND: Undetermined; seed was not separated from samaras before planting.

PERCENT GERMINATION: Low: one lot from Crater Lake yielded 16% germination (another lot, from Mt. Rainier, in stratification as of May 1993, to be planted in October '93).

EASE OF COLLECTION: Relatively easy--can bend or pull taller branches down to within reach.

METHOD OF CLEANING: None; entire samaras placed directly into flats or bags for stratifying.

STORAGE REQUIREMENTS: Keep seed moist (Corvallis PMC has not collected seed for long-term storage).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Undetermined

PROPAGATION METHOD: Seed; vegetative propagation trials have not been successful (Kruckeberg 1982).

PRETREATMENT USED: Warm, moist stratification for 6 months, followed by cold-moist stratification for 6 months (Emery 1988).

METHOD OF GROWING: Plant stratified seed, with or without attached samaras, just below soil surface in flats. Transplant to one-gallon pots in peat/soil/perlite mix.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Keep seed from drying out.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Acers generally considered to be easily transplanted; first field planting planned for 1995 or later at Crater Lake national parks.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Emery 1988; Kruckeberg 1982. Literature review in progress as of May 1993. Brief summary to be included in 1995 SCS Report on Park Service Projects.

Achillea millefolium L.

Y A R R O W

BRIEF DESCRIPTION OF NATIVE HABITAT: Distributed throughout North America in open areas from low to high elevations.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Very indeterminate seed (April to October)

NUMBER OF SEEDS PER POUND: 2,770,000

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Direct plant seed

PRETREATMENT USED: None

METHOD OF GROWING: Direct plant seed. Irrigate only under extreme drought. Lift bare-root plants or collect seed.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Direct plant seed or transplant.

CENTER NAME: Meeker Plant Materials Center

Achillea millefolium L.

WESTERN YARROW

BRIEF DESCRIPTION OF NATIVE HABITAT: Wide range, from disturbed sites to open grasslands; some understory in open conifer stands.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/20 - 10/20

NUMBER OF SEED PER POUND: 2,600,000-3,300,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Relatively easy (cut off seedheads with scythe).

METHOD OF CLEANING: Dried seedheads run through hammermill and passed through fanning mill.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: 3 to 5 years

PROPAGATION METHOD: Seeding

PRETREATMENT USED: None

METHOD OF GROWING: Although dormant fall seeding is recommended, it has been established with early spring planting.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Bridger, MT Plant Materials Center

SWEET BUCKEYE

BRIEF DESCRIPTION OF NATIVE HABITAT: Found in hardwood forests from West Virginia to southern Ohio, to Tennessee and eastern North Carolina. Prefers moist, deep soils high in organic matter.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September

NUMBER OF SEEDS PER POUND: 27-30 (U.S.D.A. 1974, 198)

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Easy

METHOD OF CLEANING: By hand (seeds are large)

STORAGE REQUIREMENTS: 40°F, 35% RH in sealed containers (ibid.)

ESTIMATED PROPAGULE STORAGE POTENTIAL: Viability drops quickly after one year storage.

PROPAGATION METHOD: Seed

PRETREATMENT USED: 86 days cold, moist stratification

METHOD OF GROWING: Pretreated seeds were sown in pots. All plantings failed in 1992.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: National Plant Materials Center

REFERENCE: U.S. Dept. of Agriculture 1974

Agave utahensis Engelm.

CENTURY PLANT

BRIEF DESCRIPTION OF NATIVE HABITAT: Data unavailable at date of publication.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED Maturity DATE: Data unavailable at date of publication.

NUMBER OF SEED PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Data not available at date of publication.

STORAGE REQUIREMENTS: Data not available at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data not available at date of publication.

PROPAGATION METHOD: Untreated seed can be sown into seed flats and transplanted to growing containers after germination, or seed can be directly sown into final containers.

PRETREATMENT USED: None

METHOD OF GROWING: Seedlings should be grown in deep containers with ridges that help prevent root spiraling. A well-drained growing medium should be used to help prevent root rot. Seedlings respond well to a constant fertilization program, where approximately 100 ppm nitrogen, phosphorus, and potassium are applied with each watering.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Los Lunas Plant Materials Center

Agrimonia parvifolia Ait.

A G R I M O N Y

BRIEF DESCRIPTION OF NATIVE HABITAT: Range from Connecticut to Michigan and Kansas, south to Georgia and Mississippi. Found in moist or dry soil.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Screening by hand

STORAGE REQUIREMENTS: 40°F, 35% RH in sealed containers

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed

PRETREATMENT USED: None

METHOD OF GROWING: Seed sown in pots; all plantings failed in spring 1992.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: National Plants Material Center

NOTE: We have not been able to propagate this species easily and do not yet have it in production.

Agrostis hyemalis (Walt.) B.S.P.

WINTER BENTGRASS

WINTER TICKLEGRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Occurs in fields, pastures, lawns, roadsides, and other areas, primarily as an early invader or in areas subjected to mowing or grazing.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Late May

NUMBER OF SEEDS PER POUND: 8,000,000

PERCENT GERMINATION: Up to 50%

EASE OF COLLECTION: Plants are easy to locate after seedhead development, but panicles dislodge from parent plants soon after ripening, are blown in the wind, and quickly dislodge the tiny seed.

METHOD OF CLEANING: Thresh hand-harvested material if necessary, and clean seed with an air-screen cleaner.

STORAGE REQUIREMENTS: Cool, dry conditions.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Three years or more.

PROPAGATION METHOD: Direct seed; summer or fall, sow on the soil surface of firm soil.

PRETREATMENT USED: None

METHOD OF GROWING: Have used light to moderate fertilizer rates and no herbicide. Cultivation is probably detrimental.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None; direct combine.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None; use air-screen cleaner. Wire screens of 40 X 40 or smaller are needed.

RE-ESTABLISHMENT TECHNIQUES: Will usually reseed following seed harvest.

CENTER NAME: James L. Whitten Plant Materials Center

ROUGH BENT GRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Open parks which are wet in spring and early summer and dry out as growing season progresses.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 7/30 - 8/21

NUMBER OF SEEDS PER POUND: 5,000,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Amount of seed collected varies greatly with thickness and purity of stand. Easy to harvest by cutting off seedheads.

METHOD OF CLEANING: Thresh with hammermill and run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Small hard seed with good viability beyond five years.

PROPAGATION METHOD: Seed production fields

PRETREATMENT USED: None noted.

METHOD OF GROWING: Establish in irrigated fields (3-ft. row spacing); swath and combine.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Broadcast seeding with raking. Some sites mulched with a bark mulch.

CENTER NAME: Bridger, MT Plant Materials Center

Agrostis scabra Willd.

WINTER REDTOP

BRIEF DESCRIPTION OF NATIVE HABITAT: Widespread; moist to dry areas, sea level to montane in N. America (Hitchcock et al. 1969). Found in patches at low elevations in Mt. Rainier.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Early August at Mt. Rainier National Park; late July - early August at Corvallis PMC.

NUMBER OF SEED PER POUND: Not recorded; estimated at 6,000,000-8,000,000 based on numbers given for other *Agrostis* species.

PERCENT GERMINATION: 1990 seed tested Mar. 1991 at 81%. Field-produced seed in 1992 had 73% germination. Seed collected at higher elevation in 1990 yielded only 5% germination.

EASE OF COLLECTION: Hand harvested; must inspect stand carefully for presence of other *Agrostis* species which would be difficult to separate out later.

METHOD OF CLEANING: Air-screen (M2B) 3/64 X 5/16 top, bottom blank
 3 time through 1/12" top, bottom blank
 1/16" top, bottom blank

STORAGE REQUIREMENTS: Dry seed stored in cloth bags in cool- to room-temperature storage room.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Not given in literature; commercial *Agrostis* seed often stored more than one year.

PROPAGATION METHOD: Direct seeding

PRETREATMENT USED: 7-day prechill treatment prior to seed germination tests; no pretreatment needed for field seeding.

Agrostis scabra

WINTER REDTOP (cont.)

METHOD OF GROWING: Direct-seeded at 2.4 lbs./ac bulk (81% germ. lot); drilled with Planet Jr. drill #10 seed plate opening/broadleaf herbicide applied in fall and hand rogueing/spot spraying to remove contaminant grasses. Weed control consisted of hand-weeding and/or roto-tilling where possible. For grass fields, chemical weed control of broadleaves consisted of one or more applications of 2,4-D + Banvel; control of grasses and broadleaves between rows consisted of wicking Roundup or spot-spraying with Roundup. Irrigation was applied in May, June, and July as necessary. For fields planted in 1991, ammonium nitrate (50 lbs N per acre) and sulfur (15 lbs S per acre) was applied in March and again in May; ammonium nitrate (50 lbs N per acre) was applied in December. Portion of stand was burned to determine effect on growth (9/08/92)--observed abundant re-growth on burned portion.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: *Agrostis* was included in the revegetation study plots installed fall 1992 at Mt. Rainier; data on growth and establishment will be collected 1993 and 1994. Literature on file at Corvallis PMC includes info on range extensions for *Agrostis scabra* and soil/nutrient relations in successional stages.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Amelanchier arborea (Michx. f.) Fern.

S H A D B L O W

S H A D B U S H

BRIEF DESCRIPTION OF NATIVE HABITAT: Maine to Wisconsin, south to western Georgia and east Mississippi. Found in hardwood forests in woods, along river banks, swamps and on rocky slopes.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Fruits

SEED MATURITY DATE: June to August

NUMBER OF SEEDS PER POUND: 79,900

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Must collect the fruits before the birds eat them.

METHOD OF CLEANING: Fruit macerated in a blender; bulk of pulp and empty seed floated off, seed dried on blotter paper, then screened and fanned to remove remaining debris.

STORAGE REQUIREMENTS: 40°F, 35% RH in sealed containers

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed

PRETREATMENT USED: 86 days cold, moist stratification tried in 1992. 1993 treatments: A) 15 minutes H₂SO₄, then 3 months cold stratification; B) 3 months cold stratification. Results not yet available.

METHOD OF GROWING: Sown in pots; all plantings failed in 1992.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Not yet tested

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Not yet tested

RE-ESTABLISHMENT TECHNIQUES: Not yet tested

CENTER NAME: National Plant Materials Center

REFERENCE: Young and Young 1992, 28-29.

Amelanchier utahensis Koehne

UTAH SERVICEBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: "Limestone soil on canyon slopes in the Guadalupe Mountains of west Texas, also New Mexico, north and west to California and Oregon" (Nokes 1986, 74).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, cuttings

SEED MATURITY DATE: Late-August - April 1

NUMBER OF SEEDS PER POUND: Approximately 26,000-31,000

PERCENT GERMINATION: "Forty percent of the seeds will germinate within 60 days" (Vories 1981, 6).

EASE OF COLLECTION: "It is usually necessary to collect large amounts of fruit because the seeds are often infertile or insect infested" (Nokes 1986, 73).

METHOD OF CLEANING: "Macerating the fruits in water and washing them over screens...removes most of the pulp. After drying and rubbing through the screens, the seeds and remaining debris can be run through an air screen" (Young & Young 1992, 29).

STORAGE REQUIREMENTS: "Seeds should be cleaned immediately to prevent fermentation...carefully air-dried and stored in sealed containers..." (Nokes 1986, 73).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Up to 5 years

PROPAGATION METHOD: Untreated seed can be sown into seed flats which can then be placed in cold stratification, or seed can be stratified before sowing. Seedlings can be transplanted from seed flats to growing containers. "Seed may be sown in the fall or prechilled seed can be sown in the spring...Seed should be sown in drill rows at the rate of 80 to 85 sound seeds per linear foot and covered with 0.5 cm of soil" (Young & Young, 30). (Softwood) **Cuttings:** "Should be three to six inches long, treated with IBA (50 mg/l for 24 hours) or Hormodin 3, and placed under mist" (Nokes 1986, 74).

PRETREATMENT USED: "Stratify seeds at 40°F for two to six months" (Nokes 1986, 74).

METHOD OF GROWING: A well-drained growing medium should be used to help prevent root rot. Seedlings respond well to a constant fertilization program, where approximately 100 ppm nitrogen, phosphorus, and potassium are applied with each watering.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Los Lunas Plant Materials Center

REFERENCE: Nokes 1986; Vories 1981; Young and Young 1992

UTAH SERVICEBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Higher sections of the Southwest from Montana to New Mexico, being especially prominent between Moab, Utah and Arches National Monument. Rocky slopes, canyons, and streambanks; 5,000-9,500 ft. elevation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: July to August

NUMBER OF SEEDS PER POUND: 36,300 to 113,800

PERCENT GERMINATION: 60%-70%

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Dry storage in sealed containers at 41°F.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed

PRETREATMENT USED: Stratify 60 days, 34°F.

METHOD OF GROWING: Seed direct planted. Plants will be lifted and stored bare root after the second year of field growth. Irrigate only under extreme drought.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Plant as rooted material.

CENTER NAME: Meeker Plant Materials Center

Anaphalis margaritacea (L.) Benth. & Hook. f.

PEARLY EVERLASTING

BRIEF DESCRIPTION OF NATIVE HABITAT: Widespread over northern North America. Occurs at low to subalpine elevation in both Crater Lake and Mt. Rainier on open slopes and meadows, roadcuts, and gravelly soils.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: July to September, depending on elevation, soil moisture.

NUMBER OF SEED PER POUND: 8,000,000-11,000,000

PERCENT GERMINATION: Variable; 47%-64% (four lots tested at OSU seed lab).

EASE OF COLLECTION: Hand harvested; usually plentiful in native stands.

METHOD OF CLEANING: Used hammermill to separate seed from forage, 3/16 screen. Scalped material in M2B 1/18 round with no air. Fine scalping with office clipper 1/22 round, 1/2 air. Larger quantities threshed much faster with Kurtz-Pelz thresher (borrowed from Oregon State Univ.).

STORAGE REQUIREMENTS: Data not available at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data not available at date of publication.

PROPAGATION METHOD: Direct seeded in cones or in plots; seed must be planted very shallow (less than 1/4" deep, max.).

PRETREATMENT USED: None

METHOD OF GROWING: Direct seeding or plugs. Plugs were planted into holes made by a dibble, 10" apart; soil was firmed around each plug. Manual weed control consisted of hoeing and/or roto-tilling where possible. Irrigation was applied in May (prior to planting) and during the growing season as necessary. Ammonium nitrate (50 lbs N per acre) and sulfur (15 lbs S per acre) were applied in March and again in May to plots planted in 1991; ammonium nitrate (50 lbs N per acre) was applied to all plots in December. Direct-seeded plots initially failed to establish; emergence occurred after plot was harrowed in May to bring seed up to surface.

Anaphalis margaritacea

PEARLY EVERLASTING (cont.)

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Seed is small and blows through screens, etc. of most harvesters; recommend clipping heads and laying out on tarps or in bags to dry .

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Harvested material must be very dry to thresh and screen properly.

RE-ESTABLISHMENT TECHNIQUES: (Experimental design): 50 pure live seeds per sq. ft. sown in individual strips within each soil treatment: 1) Control--no treatment except initial ripping, rock removal, and roto-tilling; and 2) BMP (best management practice)--incorporation of 1" peat moss, slow release fertilizer, plus installation of erosion control blanket (Sierrablen 18-7-10, 9-month release used at rate of approx. 175 lbs. nitrogen per acre; S-150 erosion control blanket used). At each site, ecotypes adapted to elevation were used. Data on establishment and growth to be collected in 1993 and 1994 from Mt. Rainier revegetation plots.

A study by Wood and Morris (1990) showed that reestablishment in a disturbed pumice soil at Mt. St. Helens depended primarily on subsurface moisture availability, and that *A. margaritacea* could colonize a wide range of habitats on the pumice plains. (Additional literature review in progress at PMC as of 1993.)

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Wood & Morris 1990

Anaphalis margaritacea (L.) Benth. & Hook. f.

PEARLY EVERLASTING

BRIEF DESCRIPTION OF NATIVE HABITAT: Common pioneer species on coarse soils, often steep slopes.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/25 - 9/15

NUMBER OF SEEDS PER POUND: 5,000,000-6,000,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Flowering is indeterminate and seed readily shatters--must collect a large amount of material to get seed.

METHOD OF CLEANING: Thresh with hammermill and run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Maintains high viability at least five years.

PROPAGATION METHOD: Establish in cone-tainers.

PRETREATMENT USED: None

METHOD OF GROWING: Have yet to try field production, only containerized material.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Must harvest when the center of the flower is dark brown.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Direct broadcast seeding (with raking) in a grass/forb mixture

CENTER NAME: Bridger, MT Plant Materials Center

B R O O M S E D G E

BRIEF DESCRIPTION OF NATIVE HABITAT: Sterile, sandy soils of abandoned fields and thin woodlands, roadsides, waste areas. This species is found in the South and southeastern states including Massachusetts, New York, Michigan, Kansas, south to Florida and Texas, California, and Mexico. It is a warm-season bunchgrass.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed culms including leaf and stem material.

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Seed is difficult to collect from this species as the seed is very small, has very hairy appendages, and remains partially enclosed in the leaf sheath. Most fields in the GSMNP with abundant plants were mowed before seed set.

METHOD OF CLEANING: No successful method has been found. Attempts were made to remove seed from culm using a hammermill. As seed is very light, seed that was removed scattered in the air. Much of the seed remained in the leaf sheath. Attempts to have seed debearded were unsuccessful.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: As seed has been very limited, no attempts to propagate seed have been made. Depending on available material, plans in 1993 are to chop vegetative and seed material and use as a mulch, which will be scattered and lightly covered with soil.

PRETREATMENT USED: None

METHOD OF GROWING: No plantings have been attempted because of limited seed material and seed-cleaning difficulties.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Tentative plans in 1993 are to harvest fields within Cades Cove of the park by mowing, raking, and baling material. This material will then be chopped in some way and mulched to an area in an attempt to establish.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Cleaning of seed will be very difficult because of the very small seed and hairy appendages.

RE-ESTABLISHMENT TECHNIQUES: No unique techniques have been determined.

CENTER NAME: Quicksand Plant Materials Center

Anemone multifida Poir.

CUTLEAF ANEMONE

BRIEF DESCRIPTION OF NATIVE HABITAT: Open meadows within a forest habitat.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 7/20 - 8/1

NUMBER OF SEEDS PER POUND: 363,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Hand stripping is slow because plants are usually scattered.

METHOD OF CLEANING: Thresh with hammermill (may add rice hulls for extra abrasion).

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Best to use before 5 years

PROPAGATION METHOD: Data not available at date of publication.

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Direct seed in grass/forb mixture.

CENTER NAME: Bridger, MT Plant Materials Center

Anemone occidentalis S. Wats.

ANEMONE
MOUNTAIN PASQUEFLOWER

BRIEF DESCRIPTION OF NATIVE HABITAT: Mountain slopes and meadows in the Cascade, Pacific, Olympic, and Wallowa Mountains in the Pacific Northwest. Common on high elevation, open pumice flats at Crater Lake, and at Sunrise Meadows in Mt. Rainier National Park.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August

NUMBER OF SEEDS PER POUND: Approximately 140,000

PERCENT GERMINATION: Moderately high with 90-day stratification (radicle emergence noted), although these seeds failed to establish plants when sown in greenhouse.

EASE OF COLLECTION: Easily gathered: ripe seedheads plentiful on high pumice ridges and fields at Crater lake, even in the drought of 1992.

METHOD OF CLEANING: Dry anemone in a drying oven to low moisture to break off long plumose "tails." Hand rub or thresh in Kurtz-Pelz thresher with large screen; scalped remaining material in office clipper, #8 screen low air.

STORAGE REQUIREMENTS: Seed should be well dried, stored in cool temperatures.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Not known--at least one year.

PROPAGATION METHOD: From seed only; does not reproduce vegetatively in natural stands (Popar 1974).

PRETREATMENT USED: 30 to 90 days stratification.

METHOD OF GROWING: Experimental: will be investigated at Corvallis PMC in 1993 and later. Initial planting germinated but did not survive, possibly because of heavy-textured, moist soil.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Seed must be very low moisture to break off plumose "tails".

RE-ESTABLISHMENT TECHNIQUES: Not known; PMC may work with park on observational trial of transplants if seedling establishment succeeds.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Popar 1974

Antennaria corymbosa E. Nels.

P U S S Y - T O E S

BRIEF DESCRIPTION OF NATIVE HABITAT: Moist meadows, and stream sides; 6,000-10,500 ft. elevation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Division

SEED MATURITY DATE: Data unavailable at date of publication.

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Data not available at date of publication.

STORAGE REQUIREMENTS: Data not available at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Division propagation was started in January. Plants were then placed into cold frame for 7 days and afterwards moved into lathhouse. *Antennaria corymbosa* had excellent vigor while in greenhouse, but when placed in lathhouse began to slowly die back to 100%. The majority of loss of plants before and after divisions is due to planting above the crown.

PRETREATMENT USED: All divisions were placed into Vitamin B-1 solution for 15 minutes to help prevent transplant shock.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Antennaria microphylla Rydb.

LITTLE LEAF PUSSYTOES

BRIEF DESCRIPTION OF NATIVE HABITAT: Open, dry slopes and understory of open canopy forest

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 6/15 - 7/10

NUMBER OF SEEDS PER POUND: 8,000,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Small, low-growing plants are poor seed producers--the most time-consuming seed to collect for NPS.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Maintains viability in excess of 5 years.

PROPAGATION METHOD: Establish in cone-tainers.

PRETREATMENT USED: None

METHOD OF GROWING: Containerized material only.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Direct broadcast seed in grass/forb mixture.

CENTER NAME: Bridger, MT Plant Materials Center

Antennaria neglecta Greene

FIELD PUSSYTOES

BRIEF DESCRIPTION OF NATIVE HABITAT: Open, dry slopes and understory of open canopy forest

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 6/15 - 7/10

NUMBER OF SEEDS PER POUND: 6,600,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Small, low-growing plants are poor seed producers--the most time-consuming seed to collect for NPS.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Maintains viability in excess of 5 years.

PROPAGATION METHOD: Establish in cone-tainers.

PRETREATMENT USED: None

METHOD OF GROWING: Containerized material only.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Direct broadcast seed in grass/forb mixture.

CENTER NAME: Bridger, MT Plant Materials Center

Aquilegia formosa Fisch. ex DC.

RED COLUMBINE

BRIEF DESCRIPTION OF NATIVE HABITAT: Widely distributed in N. America; grows at moderate elevations in Crater Lake National Park, in partially open to wooded areas; not abundant but widely scattered in park where soil retains moisture (Hitchcock et al. 1969; USDA-FS [Anon] 1988).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Late July to early August at Crater Lake; early June at Corvallis PMC.

NUMBER OF SEEDS PER POUND: Approximately 400,000

PERCENT GERMINATION: 8%, with 3-day prechill.

EASE OF COLLECTION: Hand harvested; uniquely shaped seed pods easily identified in field, does not occur in large quantities at Crater Lake.

METHOD OF CLEANING: Follicles normally open and dry at maturity. Gently crush dried heads to release remaining seed, scalp with air screen.

STORAGE REQUIREMENTS: Low R.H., preferably low temperatures.

ESTIMATED PROPAGULE STORAGE POTENTIAL: 2 years or less unless stored at low moisture in sealed containers.

PROPAGATION METHOD: Direct seeding into containers; can be spring- or fall-seeded.

PRETREATMENT USED: None required.

METHOD OF GROWING: Direct seeding or cone planting

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: PMC plans to produce one-year-old transplants for fall planting at Crater Lake National Park.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969; USDA-FS 1988

Arctostaphylos nevadensis Gray

PINEMAT MANZANITA

BRIEF DESCRIPTION OF NATIVE HABITAT: Cascade, Sierra Nevada and Blue Mts. in Northwest (Hitchcock et al. 1969); at Crater Lake as understory shrub in dry woods.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings: 1-year-old and 2-year-old wood. Fruits for seed extraction for experimental treatments only.

SEED MATURITY DATE: Data unavailable at date of publication.

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Berries easily identified and collected by hand. Moderate quantities of cuttings may be taken unobtrusively from large stands at Crater Lake.

METHOD OF CLEANING: Berries dried, then hammermilled with medium screen, then air-screened with #11 screen. Some clusters of seed 'nutlets' did not break apart in milling; these were scalped off other seed and saved separately.

STORAGE REQUIREMENTS: Cuttings can be stored in moist peat in cold room. Inspect frequently for signs of mold and mildew. Air out bags if necessary.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Seeds should withstand long-term storage; may not germinate for years in native stands.

PROPAGATION METHOD: Cuttings were treated and placed in vermiculite in a mist bed (with 60% shade) for several weeks (length of time dependent upon species). Older cuttings not treated with IBA exhibited fair root production, 43% survival, and little new growth. Seed is very difficult to germinate (Young & Young 1986). Seed will be experimentally treated with H_2SO_4 and/or thermal treatments after 1993; results will be reported in annual reports to Park Service.

PRETREATMENT USED: Varied: 1) 1-year-old or current season's growth + 0.8% IBA powder dip; 2) 1-year-old or current season's growth w/o IBA; 3) Older growth + 0.8% IBA powder dip; 4) Older growth w/o IBA.

METHOD OF GROWING: One-gallon containers containing peat/perlite/ composted soil mix held over in lathhouse at PMC after greenhouse-grown cuttings are established.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Seed is extremely hard; extensive treatment with H_2SO_4 or heat required; results have been variable even when using these methods.

RE-ESTABLISHMENT TECHNIQUES: Container-grown transplants are scheduled for fall transplanting at Crater Lake National Park in 1995 or later.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969; Young & Young 1986; USDA-FS 1988

Arnica sororia Greene

TWIN ARNICA

BRIEF DESCRIPTION OF NATIVE HABITAT: Understory plant in moderate to open canopy cover forests.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 7/20 - 7/30

NUMBER OF SEEDS PER POUND: 342,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Poor seed producer, indeterminate ripening, extensive insect predation, scattered plants.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Viability drops off within 5 years.

PROPAGATION METHOD: Establish in cone-tainers.

PRETREATMENT USED: None

METHOD OF GROWING: Containerized material only

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Little experience to date

CENTER NAME: Bridger, MT Plant Materials Center

LOW SAGEBRUSH

BRIEF DESCRIPTION OF NATIVE HABITAT: Washington to California, becoming less common eastward to Wyoming and Colorado. Dry plains, mesas, and hills; 7,000-8,000 ft. elevation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: October to December

NUMBER OF SEEDS PER POUND: 891,000 to 1,055,000

PERCENT GERMINATION: 50%-60%

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaning

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: Two years or better when stored in cloth in unheated warehouses, longer under cool conditions.

PROPAGATION METHOD: Seed

PRETREATMENT USED: Stratify 60 days, 34°F.

METHOD OF GROWING: Seeded in rows; transplanted into pots after first growing season. Sow seed in the fall at a rate that will produce approximately 50 seeds per square foot. The seed should be covered with about 1/4-inch of soil and a light straw mulch.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Direct plant seed in rows. Transplant to pots after the first season or lift bare root.

CENTER NAME: Meeker Plant Materials Center

Artemesia frigida Willd.

F R I N G E D S A G E B R U S H
W O R M W O O D
P R A I R I E S A G E W O R T

BRIEF DESCRIPTION OF NATIVE HABITAT: This species inhabits a fairly wide variety of sites, but grows most typically in full sunlight on dry, porous, coarse, gravelly, sandy, or shallow loam soils. Fringed sagebrush has an enormous range, being the most widely distributed and abundant species of the *Artemesia* genus. Its range extends from Mexico northward through the greater portion of the western United States and Canada and into Alaska.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed (achene)

SEED MATURITY DATE: Fall

NUMBER OF SEEDS PER POUND: over 4 million

PERCENT GERMINATION: About 50% of the seeds germinate quickly in 5 to 12 days in lab tests but the others germinate more slowly over a 30-day period.

EASE OF COLLECTION: Easily hand stripped from plant inflorescences.

METHOD OF CLEANING: Hand cleaned using rub board and hand screens. Screened material then placed in South Dakota seed blower to remove fine inert materials from the cleaning process.

STORAGE REQUIREMENTS: Specifics of storage not extensively investigated. Observations indicate that the species' viability can be maintained over an extended period of time. It is assumed that cold, dry storage may extend viability of *Artemesia* sp.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Stored for years under the proper environmental conditions.

PROPAGATION METHOD: Seed and vegetatively. This species has a tremendous reproductive potential. It produces an abundance of small seeds and can also reproduce itself vegetatively from rootstocks. Fringed sagebrush produces over 4 million seeds per pound. Germination occurs naturally at relatively cool temperatures. Laboratory tests have shown that optimum temperatures for germination ranged from 15°-20°C (Sabo et al. 1979).

Artemesia frigida

F R I N G E D S A G E B R U S H (cont.)

PRETREATMENT USED: Moist stratification of fresh seed for 10 days at 4°C increased the rate and amount of germination. Seed exposed to light germinated faster than that kept in darkness.

METHOD OF GROWING: Plant when soil temperatures are below 50°F. Late fall or early spring seeding when soil temperatures will remain cool and moisture will not be limiting. Surface seeding beneficial because light induces greater germination where surface moisture assured, e.g., with irrigation or where snowmelt extends for a few weeks. Otherwise, seeding at depths 4 times diameter of seed advised.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Seed harvested by stripping or rubbing into containers or, where heads are well extended, using electric hedge cutters.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Clean by hammermilling or mechanically flailing; recleaned in fanning mill.

RE-ESTABLISHMENT TECHNIQUES: Data unavailable at date of publication.

CENTER NAME: Manhattan Plant Materials Center

REFERENCES: Barr 1983; Cooperrider and Bailey 1986; Looman 1983; Stubbendieck et al. 1982; U.S. Dept. of Agric. 1937, 1974, 1985; Sabo et al. 1979; Young and Young 1986.

Artemisia ludoviciana Nutt.

S A G E W O R T

BRIEF DESCRIPTION OF NATIVE HABITAT: Dry, open places. B.C. to Calif., east to Ontario, Arkansas (Hitchcock et al. 1969). In Mt. Rainier, at mid elevations up to subalpine, forming large patches along road cuts and other disturbed places.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Late July to mid-to-late August at Mt. Rainier; mid-to-late July at PMC.

NUMBER OF SEED PER POUND: Not determined

PERCENT GERMINATION: 63% (after 14-day prechill) to 9% (2-day prechill)

EASE OF COLLECTION: Hand harvested; can use sickle to harvest from large patches growing along roadsides--one of the more easily collected.

METHOD OF CLEANING: Kurtz-Pelz thresher, setting #6 screen, air closed, belt speed 1-2. Office clipper screen, 1/12" screen, hand sifted with 1/13" screen.

STORAGE REQUIREMENTS: Dry/cool

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Direct seeding, Planet Jr. #7; or hand seed into containers.

PRETREATMENT USED: Germination at OSU seed lab enhanced by 14-day prechill.

METHOD OF GROWING: Direct seeding or plugs. Plugs were planted into holes made by a dibble, 10" apart; soil was firmed around each plug. Manual weed control consisted of hoeing and/or roto-tilling where possible. Irrigation was applied in May (prior to planting). Ammonium nitrate (50 lbs N per acre) and sulfur (15 lbs S per acre) were applied in March and again in May to plots planted in 1991; ammonium nitrate (50 lbs N per acre) was applied to all plots in December.

Artemisia ludoviciana

S A G E W O R T (cont.)

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Since plant is rhizomatous, may be possible to dig and divide clumps; however, since production is easily obtained from seed, no vegetative propagation is planned at PMC.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: (Experimental design): 35 pure, live seeds per sq. ft. sown in individual strips within each soil treatment: 1) Control--no treatment except initial ripping, rock removal, and roto-tilling; and 2) BMP (best management practice) incorporation of 1" peat moss, slow release fertilizer, plus installation of erosion control blanket (Sierrablen 18-7-10, 9-month release used at rate of approx. 175 lbs. nitrogen per acre; S-150 erosion control blanket used). At each site, ecotypes adapted to elevation were used. Data from revegetation plot trials will be collected in 1993 and 1994.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Asimina triloba (L.) Dunal

P A W - P A W

BRIEF DESCRIPTION OF NATIVE HABITAT: Eastern Pennsylvania to south Michigan, south to northern South Carolina and northern Mississippi, west to eastern Kansas. Found as an understory tree in deep, rich soil.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August - September

NUMBER OF SEEDS PER POUND: 700 (U.S. Dept. of Agriculture 1974)

PERCENT GERMINATION: 50%-80% (ibid.)

EASE OF COLLECTION: Collected from ground

METHOD OF CLEANING: Animals had cleaned fruit at the collection site.

STORAGE REQUIREMENTS: 40°F, 35% RH in sealed polyethylene bags

ESTIMATED PROPAGULE STORAGE POTENTIAL: At least 2 years

PROPAGATION METHOD: Seed

PRETREATMENT USED:

1992: 86 days cold, moist stratification.

1993: a) 20 minutes H₂SO₄, then 3 months cold stratification;
b) 3 months cold stratification. Test results not yet available.

METHOD OF GROWING: In flats in the greenhouse. Germination is not uniform and occurs over a 2-month span. Seedlings were transplanted to pots. Seedlings are difficult to transplant bare-rooted and are currently being container-grown.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: See above.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Container-grown transplants

CENTER NAME: National Plant Materials Center

REFERENCE: Young and Young 1992, 45-46

Aster cordifolius L.

HEARTLEAF ASTER

BRIEF DESCRIPTION OF NATIVE HABITAT: Occurs along roadsides, in forest clearings and at forest edges, and in other idle areas, chiefly as scattered plants on upland situations.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: October - November

NUMBER OF SEED PER POUND: Not definitely known; perhaps 3 to 4 million

PERCENT GERMINATION: 25%-50%

EASE OF COLLECTION: Harvest is slow, but not difficult. Hand harvest is necessary in the field, and the scarcity of plants makes harvest time-consuming.

METHOD OF CLEANING: Little cleaning of material initially harvested was done. Large trash was removed by hand. Attached flower parts and very small seed made cleaning by machine impractical.

STORAGE REQUIREMENTS: Unknown; probably cool, dry conditions.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Unknown; at least one year.

PROPAGATION METHOD: Planted from seed.

PRETREATMENT USED: None

METHOD OF GROWING: Very poor germination resulted from direct seeding a clean-tilled seedbed in May. Limited numbers of plants have been started in a greenhouse and transplanted into a production area. Plants are not injured by tillage between rows.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Seeds are very tiny, and attached flower parts make these seeds very difficult to machine harvest. Some type of a flail-vacuum harvester could possibly be used if air does not blow seed from the machine. Hand harvest has been the only method used so far. Flower parts could be removed with the proper brush or roll machine.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: The seed is essentially impossible to clean by machine with the flower parts attached. A debearder or similar machine might successfully remove these flower parts and make cleaning with an air-screen cleaner possible.

RE-ESTABLISHMENT TECHNIQUES: Unknown; a planting trial involving planting seed on the soil surface of an untilled area is underway.

CENTER NAME: James L. Whitten Plant Materials Center

Aster foliaceus Lindl. ex DC.

ASTER

BRIEF DESCRIPTION OF NATIVE HABITAT: Moist places at moderate to high elevations (lower elev. further north), Alaska to New Mexico (Hitchcock et al. 1969). Collected around 3,500-5,000 ft. at Mt. Rainier in moist meadows, near ditches, seeps.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seedheads

SEED MATURITY DATE: Mid-August to early September at Mount Rainier; June to July at Corvallis PMC.

NUMBER OF SEEDS PER POUND: Approximately 900,000

PERCENT GERMINATION: 1990 collection - 66%; 1991 - 37%. X-ray examination of 1991 seed showed 83% filled seed, 17% empty.

EASE OF COLLECTION: Fairly slow; seedheads pinched off from scattered plants. *Juncus* sp. seed ended up in the native collection.

METHOD OF CLEANING: Started with a dry, low moisture content. Used a rubbing tray to get rid of fuzz; scalped on office clipper to get rid of large material, 1/14" screen and 1/16" screen, low air.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Not determined

PROPAGATION METHOD: Seeded to cone-tainers, 3-5 seeds/cone; thinned to one plant per cone.

PRETREATMENT USED: None

METHOD OF GROWING: Plugs were planted into holes made by a dibble, 10" apart, in 30" rows; soil was firmed around each plug. Manual weed control consisted of hoeing and/or roto-tilling where possible. Irrigation was applied in May (prior to planting).

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Added moth balls to paper sacks during seed drying to drive off thrips and other insects.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Seedheads were heavily infested with insects when collected; mothballs used to repel insects. Dry quickly to prevent further insect predation on seed.

RE-ESTABLISHMENT TECHNIQUES: Container-plug transplanting planned.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Aster glaucodes Blake

BLUE LEAF ASTER

BRIEF DESCRIPTION OF NATIVE HABITAT: Wyoming, Colorado, and Utah to northern Arizona. Mountains--6,500-9,500 ft. elevation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Indeterminate seeds (August through October)

NUMBER OF SEEDS PER POUND: 540,000

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Direct seed

PRETREATMENT USED: None

METHOD OF GROWING: Direct seed or transplant. Moderate water requirement.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Preferable to use flail-vac and harvest over time.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Debearder required for seed.

RE-ESTABLISHMENT TECHNIQUES: Direct seed or transplant.

CENTER NAME: Meeker Plant Materials Center

THICK STEM ASTER

BRIEF DESCRIPTION OF NATIVE HABITAT: Open meadows; pioneer species on some disturbed sites.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/25 - 9/10

NUMBER OF SEEDS PER POUND: 510,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Amount of seed collected dependent on density of stand and seed set. Can be readily collected cutting off seedheads.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Viability good for at least 5 years.

PROPAGATION METHOD: Establish in cone-tainers. Limited success with raising seed in seed production plots.

PRETREATMENT USED: 7-day prechill at 2°-5°C

METHOD OF GROWING: Containerized material; field production with hand stripping of seed.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: As with most species in Asteraceae family, this plant is susceptible to insect damage of developing seed-heads.

RE-ESTABLISHMENT TECHNIQUES: Has been included in grass/forb mixtures, broadcast-seeded and raked.

CENTER NAME: Bridger, MT Plant Materials Center

Aster laevis L.

SMOOTH ASTER

BRIEF DESCRIPTION OF NATIVE HABITAT: Open parks and meadows within cedar-hemlock forest, spruce-subalpine fir, and high elevations (tundra).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed; Glacier National Park has transplanted sod with this species present.

SEED MATURITY DATE: 8/30 - 9/10

NUMBER OF SEEDS PER POUND: 1,300,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Relatively slow because of scattered stands and often poor fill.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Good viability for up to 5 years.

PROPAGATION METHOD: (PMC has cleaned only.)

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Direct broadcast seeding and raking. Glacier N.P. has seed flat with mixture and transplanted sod transfer from native to reclamation site.

CENTER NAME: Bridger, MT Plant Materials Center

Aster modestus Lindl.

M O D E S T O A S T E R

BRIEF DESCRIPTION OF NATIVE HABITAT: Moist woodlands, often riparian areas. Alaska to Oregon and east to Minnesota (Hitchcock et al. 1969). Collected at Crater Lake near streams, seeps, lush meadows.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: 1991 collection yielded 24% (no prechill); X-ray testing showed 79% filled seed, 21% empty seed.

EASE OF COLLECTION: Collecting seed into paper sacks fairly slow; individual seedheads picked. Asters occur in scattered stands mixed with other grasses and forbs.

METHOD OF CLEANING: Start with low moisture content, then use a rubbing tray to separate seed. Scalp material off with office clipper 1/14" and 1/16" screen low air.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Direct seeded into cone-tainers

PRETREATMENT USED: None

METHOD OF GROWING: Established in greenhouse in spring and held in lathhouse over summer; fall transplanting in 1992 at PMC was successful; other plants retained in cone-tainers in lathhouse over winter also regrowing.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Seedheads infested with insects (thrips and others); mothballs added to sacks of seed to repel insects. Seed should be dried as soon as possible to limit further insect damage.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Fall transplanting from cone-tainers is planned.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Baptisia tinctoria (L.) R. Br.

WILD INDIGO

BRIEF DESCRIPTION OF NATIVE HABITAT: Erect, branching perennial herb adapted to dry open sites from Maine to Florida and west to Minnesota.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August - September

NUMBER OF SEEDS PER POUND: 800,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Easily found in most disturbed areas in Cape May County, NJ (i.e., power lines, roadsides, clear cuts, etc.). Only one seed per pod, which is approximately five times larger.

METHOD OF CLEANING: Hand rub or lightly run through hammermill.

STORAGE REQUIREMENTS: Air dry for 1 to 2 days, then store in dehumidified room @ <40°F.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Currently unknown

PROPAGATION METHOD: Early spring field seeding in sandy loam at rate of 15 lbs./acre. Weed control: cultivation and hand weeding. Irrigation: one inch biweekly.

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Cape May Plant Materials Center

Berberis fremontii Torr.

DESERT BARBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Found in dry rocky places at 900-1,500 m. elevation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: 42,676

PERCENT GERMINATION: 60%-80% on average

EASE OF COLLECTION: Data not available at date of publication.

METHOD OF CLEANING: "Ripe barberry fruits...may be run through a macerator with water and the pulp separated by flotation" (Young and Young 1992, 54).

STORAGE REQUIREMENTS: "The seeds should be dried and either sown immediately or stored in sealed containers at temperatures slightly above freezing" (ibid.).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Up to 5 years

PROPAGATION METHOD: Untreated seed can be sown into seed flats which can then be placed in cold stratification, or seed can be stratified before sowing. Seedlings can be transplanted from seed flats to growing containers.

PRETREATMENT USED: None required, but some lots will be improved by 45 days prechill (Dept. of Agriculture 1985).

METHOD OF GROWING: A well-drained growing medium should be used to help prevent root rot. Seedlings respond well to a constant fertilization program, where approximately 100 ppm nitrogen, phosphorus, and potassium are applied with each watering.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: "Whole berries or, preferably, cleaned seed may be sown in the fall, or prechilled and sown in the spring. Injury from damping-off is more likely if fruits are used. Fall-sown beds should be mulched before germination begins. The seeds should be covered with 0.5-1 cm of soil plus 5 cm of sand" (Young and Young 1992, 54).

CENTER NAME: Los Lunas Plant Materials Center

REFERENCE: Young and Young 1992; U.S. Dept. of Agriculture 1985.

Bouteloua breviseta Vasey

CHINO GRAMA

BRIEF DESCRIPTION OF NATIVE HABITAT: Gypsum sands and calcareous rocks; western Texas, New Mexico, and northern Mexico.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed and plants

SEED MATURITY DATE: November

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Difficult due to short flowering and seed-set period, prolific shattering, low seed viability, and difficult access to collection sites.

METHOD OF CLEANING: Shaker air-screen separation

STORAGE REQUIREMENTS: Undocumented--standard storage being used.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Undocumented--standard procedure being used.

PROPAGATION METHOD: Seed and transplants

PRETREATMENT USED: None

METHOD OF GROWING: Direct seeding; transplanting on normally prepared listed beds; irrigation, cultivation, and fertilization.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Standard range-seeding methodology recommended for the Trans-Pecos region of Texas.

CENTER NAME: Knox City Plant Materials Center

REFERENCES: Hitchcock 1971, 541-42; Gould 1978, 351.

Bouteloua hirsuta Lag.

HAIRY GRAMA

BRIEF DESCRIPTION OF NATIVE HABITAT: Wisconsin and Illinois to North Dakota and south to Louisiana, Texas, New Mexico, Arizona, southern California and south through Mexico; on a wide variety of soil types, in forested areas only in grassy openings and woods borders.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: November

NUMBER OF SEED PER POUND: 685,000

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Relatively easy to collect but seed viability was low.

METHOD OF CLEANING: Shaker, air-screen separation

STORAGE REQUIREMENTS: Standard procedure

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed and transplants

PRETREATMENT USED: None

METHOD OF GROWING: Direct seeding; transplanting on normally prepared listed beds; irrigation, fertilization, cultivation.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Standard range-seeding methodology recommended for the Cross-Timbers region of Oklahoma.

CENTER NAME: Knox City Plant Materials Center

REFERENCES: Gould 1978, 353.

Bromus anomalus Rupr. ex Fourn.

NODDING BROMEGRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: North Dakota to western Texas. Open woods; loamy soils; 6,000-8,000 ft. elevation; 16-24 in. precipitation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August to September

NUMBER OF SEEDS PER POUND: 40,000-150,000

PERCENT GERMINATION: Presumed to be good the first year, but decreasing rapidly after the second year.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: Assumed to be short-lived.

PROPAGATION METHOD: Seed

PRETREATMENT USED: None

METHOD OF GROWING: Direct plant seed one inch deep on medium textured soils. Seeding rate should be about 8-12 lb. PLS per acre. Seed should be drilled in late fall or early summer.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Debearder required for seed.

RE-ESTABLISHMENT TECHNIQUES: Direct planted by seed.

CENTER NAME: Meeker Plant Materials Center

MOUNTAIN BROME*
CALIFORNIA BROME

* (Not to be confused with the European 'Deborah' Mountain brome, which is sometimes erroneously sold commercially as "native mountain brome" (David Amme, personal communication.)

BRIEF DESCRIPTION OF NATIVE HABITAT: Variable species consisting of many races with various habitats, from moist woods to meadows, sagebrush hills, also waste or disturbed areas, foothills to mountains; Alaska to Baja Calif., east to Dakotas and south to New Mexico. At Crater Lake, in dry meadows, near roads.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: July to August at Crater lake; June to early July at Corvallis.

NUMBER OF SEEDS PER POUND: Avg. 81,500 (our collections and field-grown seeds have ranged from 78,000 to over 82,000).

PERCENT GERMINATION: Variable: 31% (collected in drought year of 1992) up to 63%

EASE OF COLLECTION: Can be rapidly hand stripped from plants but seedheads should first be carefully examined for smut. If present, careful selection of seed in field will be in order.

METHOD OF CLEANING: Small lots: 3/16" hammermill to thresh; air-screen with office clipper, #14 screen.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Not determined

PROPAGATION METHOD: Direct seeded, 30-40 seed/ft. row, 12" row spacing (seeded with Planet Jr., #39 hole).

Bromus carinatus

MOUNTAIN BROME*
CALIFORNIA BROME (cont.)

* (Not to be confused with the European 'Deborah' Mountain brome, which is sometimes erroneously sold commercially as "native mountain brome" (David Amme, personal communication.)

PRETREATMENT USED: None. In retrospect, seed from 1990 contract collection should have been treated for smut if any seed treatment (such as Vitavax) can be found that is labeled for brome.

METHOD OF GROWING: Stand establishment, first year: hand rogue and spot spray contaminant grasses; 2,4-D used to eliminate broadleaf weeds. Irrigation provided first year only, during establishment. "Tilt" fungicide applied during spring of second year for rust control. 50 lbs. N + 15 lbs. S/acre applied in March and May of second year.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Possible presence of smut in seedheads requires close inspection during collection. Stand produced from contract-collected seed developed approximately 50% smutted seedheads; this field was hand harvested from individually inspected, clean seedheads for stand reestablishment. Seed picked over by hand prior to replanting.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Direct-seeding in fall planned for Crater Lake revegetation projects.

CENTER NAME: Corvallis Plant Materials Center

Bromus vulgaris (Hook.) Shear

C O L U M B I A B R O M E

BRIEF DESCRIPTION OF NATIVE HABITAT: Sea level to montane meadows; B.C. to Sierra Nevadas, east to Wyoming (Hitchcock et al. 1969). Found in clearings, ditches, grassy areas in Mt. Rainier, mainly at lower elevations (below 4,000 ft.).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: End of July to August at Mt. Rainier; early to mid-July at PMC.

NUMBER OF SEED PER POUND: Variable: 79,600-119,500

PERCENT GERMINATION: 43%-86%

EASE OF COLLECTION: Hand harvested

METHOD OF CLEANING: Thresh all material in hammermill and to de-awn, 3/16" screen. Scalp in office clipper #14 screen, 3/4 air.

STORAGE REQUIREMENTS: Dry/cool

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Direct seeded

PRETREATMENT USED: None (5-day prechill used during seed testing did not enhance germination).

METHOD OF GROWING: Weed control consisted of hand weeding and/or rototilling where possible. For grass fields, chemical weed control of broadleaves consisted of one or more applications of 2,4-D + Banvel; control of grasses and broadleaves between rows consisted of wicking Roundup or spot-spraying with Roundup. Irrigation was applied in May, June, and July as necessary. For fields planted in 1991, ammonium nitrate (50 lbs N per acre) and sulfur (15 lbs S per acre) was applied in March and again in May; ammonium nitrate (50 lbs N per acre) was applied in December.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Carefully inspect seedheads in both native and seed-increase stands for smut; if present, hand harvest individual seedheads to avoid smut.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Planned for direct seeding for revegetation, high-elevation ecotype was included in 1992 revegetation plot study at Mt. Rainier, data

RE-ESTABLISHMENT TECHNIQUES: Planned for direct seeding for revegetation. High-elevation ecotype was included in 1992 revegetation plot study at Mt. Rainier; data on stand establishment and growth will be included in annual reports.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Calernagrostis breweri Thurb.

REED GRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Moist subalpine and alpine meadows, lake margins, streambanks; 4,225-12,350 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Division, seed

SEED MATURITY DATE: Quantitative values for date of maturity could not be found.

NUMBER OF SEEDS PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: (1990) Seed hand screened with size 1/12". Cleaned on small clipper using screens 1/12" top and 1/22" bottom with air closed and taped.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Division propagation was started in January. Plant was divided into 3 or 4; divisions were then placed into cold frame for 7 days and afterwards moved into lathhouse. The majority of loss of plants before and after division is due to planting above the crown.

PRETREATMENT USED: Divisions were placed into Vitamin B-1 solution for 15 minutes to help prevent transplant shock. Seed: none required.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Calamagrostis canadensis (Michx.) Beauv.

BLUEJOINT REEDGRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Greenland to Alaska, south to Maryland, North Carolina, Missouri, Kansas, Colorado, Arizona, and California. Marshes, wet places, open woods, meadows, wet thickets and streamsides; 5,000-11,000 ft. elevation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: July to August

NUMBER OF SEEDS PER POUND: 3,500,000-4,000,000

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner at the UCEPC. An alternate method is to thresh the panicles with a hammermill. Seed should be fed into the hammermill at 1200 rpm operation, which is equipped with a screen with 0.5-inch-diameter, round holes.

STORAGE REQUIREMENTS: Can survive dry storage at room temperature. However, long-term storage is best under cool, dry conditions (33°-45°F).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Seed remain viable (>84%) for at least two years after collection and storage.

PROPAGATION METHOD: Seed

PRETREATMENT USED: None

METHOD OF GROWING: Seed should be spring planted at from 3/4-1 in. depth. Soil should be moist to saturated at time of planting, but with no standing water. From 2-4 lb. PLS per acre should be planted. Rows should be from 2-2.5 ft. apart. Seed can be collected or whole plants or rhizomes can be dug.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Rhizomes should be maintained under moist conditions until the time of planting. Cool, moist storage at approximately 35°F will minimize damage until planting.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Debearder is required for seed processing.

RE-ESTABLISHMENT TECHNIQUES: Rhizomes best for reestablishment.

CENTER NAME: Meeker Plant Materials Center

Callicarpa americana L.

AMERICAN BEAUTYBERRY

FRENCH MULBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Widely distributed in Louisiana (Brown 1965). Diverse, relatively open or closely canopied, usually well-drained woodlands and their borders, thickets, fence and hedge rows (Godfrey 1988).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Flowers: May-June. Fruits: Aug.-Sept., can persist to January (USDA 1977).

NUMBER OF SEEDS PER POUND: 130,000 (ibid.).

PERCENT GERMINATION: Approximated at 50% (Douglas 1993).

EASE OF COLLECTION: Readily accessible

METHOD OF CLEANING: Hand, de-pulp, and dry

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seeded in trays; seedlings transplanted to containers.

PRETREATMENT USED: None

METHOD OF GROWING: Container

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Container-grown and transplanting

CENTER NAME: None - PMS office Baton Rouge, LA

REFERENCES: Brown 1965; Douglas 1993; Godfrey 1988; USDA 1977

Carex exserta MacKenzie

SHORT-HAIR SEDGE

BRIEF DESCRIPTION OF NATIVE HABITAT: Meadows; 7,000-10,000 ft. elev.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, plant division

SEED MATURITY DATE: Quantitative values for seed maturity could not be found.

NUMBER OF SEED PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

STORAGE REQUIREMENTS: Longevity of seed unknown; no known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Division propagation was started in January. Plant was divided into 3 or 4. Plants were then placed into cold frame for 7 days and then moved into lathhouse. The majority of loss of plants before and after divisions is due to planting above the crown; care must be taken to plant exactly at the crown.

PRETREATMENT USED: Divisions were placed into Vitamin B-1 solution for 15 minutes to help prevent transplant shock. Seeds: none.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Carex halliana Bailey

HALL'S SEDGE

BRIEF DESCRIPTION OF NATIVE HABITAT: Dry, open slopes and dry meadows in Cascade Mts. (Hitchcock et al. 1969). Widespread in open meadows at Crater Lake.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Extremely variable--early July to August

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Less than 1% germination has been achieved at PMC; 0% germination reported by OSU seed lab.

EASE OF COLLECTION: Data not available at date of publication.

METHOD OF CLEANING: Hammermill 1/16" screen to thresh seed free. Oat de-huller twice; office clipper 1/12", 1/13", 1/18", 1/20" round, med. air.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Few plants produced from seed, but these have been vegetatively divided, taking advantage of rhizome production.

PRETREATMENT USED: 1) Seeds leached under running water (60 hr.); 2) seeds leached as mentioned, then placed in germination media; 3) seeds dehulled and leached. Exhibited little or no germination.

METHOD OF GROWING: See "Status" information, below.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Since this sedge produces robust rhizomes which can be divided from mother plant, we would recommend salvaging rhizomes and plants from any areas where Hall's sedge is to be disturbed/destroyed for construction projects.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

STATUS: This species was not included in original cooperative agreement and was collected for initial evaluation/observation only at the PMC. Germinated seedlings were kept and are being maintained in lathhouse; several rhizomes have developed and these were divided and replanted.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Carex mariposana Bailey ex Mackenzie

MARIPOSA SEDGE

BRIEF DESCRIPTION OF NATIVE HABITAT: Meadows; 3,900-10,400 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Quantitative values for date of maturity could not be found.

NUMBER OF SEEDS PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: (1990) Hand-screened twice using size 7 screen to separate seed from seedhead. Two runs on small clipper using screens 1/12 top and 1/22 bottom with air closed and taped off. Seed cleaned well, dropping into center bottom tray and all chaff blown off. Easy separation of inert from seed.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Time-controlled misters used in greenhouse and temperature maintained at 65°-70°F.

PRETREATMENT USED: Seed: none.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Carex mertensii Prescott ex Bong.

MERTEN'S SEDGE

BRIEF DESCRIPTION OF NATIVE HABITAT: Alaska & Yukon south to California in wet places (Hitchcock et al. 1969). At lower elevations of Mt. Rainier, near streams, ditches, seeps.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August to Sept. at Mt. Rainier; July at PMC.

NUMBER OF SEEDS PER POUND: Approximately 1,565,500

PERCENT GERMINATION: 53%-63%

EASE OF COLLECTION: Hand harvested

METHOD OF CLEANING: Hammermill for threshing 1/16" screen; oak dehuller 45 sec. each batch; office clipper 8" screen, 1/20" round, med. air.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Direct seeding

PRETREATMENT USED: None

METHOD OF GROWING: Carbon-banded with drill in 30" rows, at 100 seeds per row-foot; sprayed immediately after planting with Karmex (broad spectrum weed control), at 2.2 lbs a.i. per acre. Manual weed control consisted of hand-weeding and/or roto-tilling where possible. Chemical weed control of grasses and broadleaves between rows consisted of wicking Roundup, or spot-spraying with Roundup. Irrigation was applied in May, June, and July as necessary. For sedges planted in 1992, ammonium nitrate (25 lbs N per acre) was applied in December. For rust control, Tilt was applied to established fields in early March, late March, mid April, early May, and to all fields in late August.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Two seed cleaners noticed that chaff was irritating to skin and eyes: gloves, goggles, and dust masks may be needed to clean large quantities of seed.

RE-ESTABLISHMENT TECHNIQUES: Three ecotypes included in 1993 Mt. Rainier revegetation study; growth and establishment data will be collected in 1993 and 1994. Results will be reported in annual reports.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Carex microptera Mackenzie

S M A L L - W I N G S E D G E

BRIEF DESCRIPTION OF NATIVE HABITAT: Wet, open-edge meadows within Rocky Mountain National Park at elevations from 6,500-11,000 ft. Occurs from Colorado west to California and from Montana south to northern Arizona and New Mexico.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: July to September

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry conditions (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: Up to 2 years under cool, dry storage.

PROPAGATION METHOD: Seed

PRETREATMENT USED: 60-day soak in 33°-45°F distilled water under dark conditions.

METHOD OF GROWING: Soak seed in 33°-45°F water for 60 days. Plant in moist but not submerged soil. Can obtain seed or transplant by rhizome.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Rhizomes should be maintained under moist conditions until the time of planting. Cool, moist storage at approximately 35°F will minimize damage until planting.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Information unavailable

RE-ESTABLISHMENT TECHNIQUES: Best to establish by rhizome.

CENTER NAME: Meeker Plant Materials Center

Carex obnupta Bailey

SLOUGH SEDGE

BRIEF DESCRIPTION OF NATIVE HABITAT: Water or very wet soil along rivers or in swamps from Cascades to Pacific coast (Hitchcock et al. 1969).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Late July to early August

NUMBER OF SEEDS PER POUND: Not determined: approximately 300,000-400,000 based on size comparison with *C. pachystachya*.

PERCENT GERMINATION: 30%, with 2-day prechill

EASE OF COLLECTION: Easily collected, but not plentiful.

METHOD OF CLEANING: Hand threshed, air-screened with 1/8" round screen, moderate air.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Direct seeded

PRETREATMENT USED: None prior to seeding; 2-day prechill prior to germination testing.

METHOD OF GROWING: Stand emerged slowly at PMC and did not establish: needs heavy irrigation to provide wet soils.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Needs very wet soil.

STATUS: Slough sedge was dropped from the targeted species list for Mt. Rainier in 1991 because of its need for very wet conditions.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Carex pachystachya Cham. ex Steud.

THICK-HEADED SEDGE

BRIEF DESCRIPTION OF NATIVE HABITAT: Sea level to timberline in mountains; Alaska to Sierra Nevada, east to Wyoming, Montana. Open, somewhat dry slopes in moist regions of mountains (Hitchcock et al. 1969). Widely distributed in meadows at broad elevation range in both Mt. Rainier and Crater Lake national parks.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: End of July through August at Mount Rainier and Carter Lake; late June to July at Corvallis.

NUMBER OF SEEDS PER POUND: 908,000 (with hulls); dehulled seed, approx. 1,375,700/lb.

PERCENT GERMINATION: 84% for dehulled seeds, 14% for seed with hulls intact (apparently contain germination inhibitor).

EASE OF COLLECTION: Hand harvested

METHOD OF CLEANING: Hammermill for threshing 3/16" screen; oat dehuller twice, no settings; office clipper 1/20" screen to completely clean.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Not determined; may be years since hull apparently contains germination inhibitors.

PROPAGATION METHOD: Dehulled seed can be direct sown, or seed can be fall planted without dehulling.

PRETREATMENT USED: None

METHOD OF GROWING: Carbon-banded with drill in 30" rows at 100 seeds per row-foot; sprayed immediately after planting with Karmex (broad spectrum weed control) at 2.2 lbs. a.i. per acre. Manual weed control consisted of hand-weeding and/or roto-tilling where possible. Chemical weed control of grasses and broadleaves between rows consisted of wicking Roundup, or spot-spraying with Roundup. Irrigation was applied in May, June, and July as necessary. For sedges planted in 1992, ammonium nitrate (25 lbs N per acre) was applied in December. For rust control, Tilt was applied to established fields in early March, late March, mid April, early May, and to all fields in late August.

Carex pachystachya

THICK-HEADED SEDGE (cont.)

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Inspect native stands carefully for presence of smut; avoid as much as possible. Larger smutted seed can be scalped off during screening but remaining seed should be hand-inspected and cleaned.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Dehulling accomplished quickly and easily with Quaker Oat Dehuller, borrowed from agronomy department at Oregon State University.

RE-ESTABLISHMENT TECHNIQUES: *C. pachystachya* is included in the revegetation study installed at Mt. Rainier in 1992. Data on emergence and establishment will be recorded in 1993 and 1994.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Carex rossii Boott

ROSS SEDGE

BRIEF DESCRIPTION OF NATIVE HABITAT: Dry forest and meadows; 7,000-10,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, plant division

SEED MATURITY DATE: Quantitative values for date of maturity, etc. could not be found.

NUMBER OF SEED PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Division propagation was started in January. Plant was divided into 3 or 4, and divisions were then placed into cold frame for 7 days and afterwards moved into lathhouse. Those divisions planted with the crown below soil surface level had the greatest fatality rate.

PRETREATMENT USED: Divisions were placed into Vitamin B-1 solution for 15 minutes to help prevent transplant shock. Seed: none.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Carex spectabilis Dewey

SHOWY SEDGE

BRIEF DESCRIPTION OF NATIVE HABITAT: Found in meadows and moist places at higher elevations and above timberline in the cordilleran region, ranging from Alaska and the Yukon south to California, and east to Montana, as well as areas in Asia. Most common at the base of steep, windward slopes where average snowmelt occurred July 1 to July 20 (Hitchcock et al. 1969). Present at Crater Lake and Mt. Rainier national parks.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August

NUMBER OF SEEDS PER POUND: Not recorded

PERCENT GERMINATION: 22%-42%

EASE OF COLLECTION: Hand harvested

METHOD OF CLEANING: Hammermill to thresh 3/16" screen; office clipper #14 screen, med. air.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Direct seeding

PRETREATMENT USED: Two-week prechill used in germination tests; seeded cone-tainers left outside for one week in spring to provide prechill, improve germination rates.

METHOD OF GROWING: Manual weed control consisted of hand weeding and/or roto-tilling where possible. Chemical weed control of grasses and broadleaves between rows consisted of wicking Roundup, or spot-spraying with Roundup. Irrigation was applied in May, June, and July as necessary. For sedges planted in 1992, ammonium nitrate (25 lbs N per acre) was applied in December. For rust control, Tilt was applied to established fields in early March, late March, mid April, early May, and to all fields in late August.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Micrositing and/or soil amendment to provide topsoil and increase water retention on denuded alpine meadows may be necessary for successful reintroduction, either as transplants or by direct seeding.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

SEDGE

BRIEF DESCRIPTION OF NATIVE HABITAT: Open, wet meadows, 6,500-11,000 ft. in elevation, Rocky Mountain National Park.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: July to September

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: Up to two years under cool, dry storage.

PROPAGATION METHOD: Seed, or by rhizome

PRETREATMENT USED: Store seed for 60 days in 33°-45°F distilled water under dark conditions.

METHOD OF GROWING: Pretreat seed for 60 days in 33°-45°F distilled water. Plant seed in moist but not inundated soil. Can either harvest seed or transplant by rhizome.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Rhizomes should be maintained under moist conditions until the time of planting. Cool, moist storage at approximately 35°F will minimize damage until planting.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Best to re-establish by rhizome.

CENTER NAME: Meeker Plant Materials Center

Carya aquatica (Michx. f.) Nutt.

WATER HICKORY

BRIEF DESCRIPTION OF NATIVE HABITAT: Found mostly in poorly drained, heavy clay flats; largest specimens are found in the lower Mississippi Valley (USDA 1977). Also, natural levees and banks of rivers and streams, and flood plain forests where the duration of flooding is relatively brief (Godfrey 1988).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Flowers: March-May. Fruits: Sept.-Nov. (USDA 1974).

NUMBER OF SEEDS PER POUND: 164 (USDA 1977).

PERCENT GERMINATION: 76% (USDA 1974).

EASE OF COLLECTION: Readily accessible

METHOD OF CLEANING: Persistent husks can be removed by hand, by trampling, or by running through a corn sheller (ibid.).

STORAGE REQUIREMENTS: Nuts can be stored for 3 to 5 years in closed containers at 41° F and 90% humidity (ibid.).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Same as above.

PROPAGATION METHOD: Fall sowing with untreated seed or spring sowing with stratified seed. Drilling/planted, 3/4-1-1/2 in. deep.

PRETREATMENT USED: Hickories exhibit embryo dormancy. Pregermination treatments are stratification in moist medium at 33°-40° F for 30 to 150 days. Seeds stored for more than a year may require only 30 to 60 days stratification. If cold storage facilities are not available, pit stratification with about 2 ft. of compost, leaf, or soil cover to prevent freezing will suffice. Prior to cold treatment, nuts should be soaked in water at room temperature for 2 to 4 days with 1 to 2 water changes per day (ibid.).

METHOD OF GROWING: Container

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Container-grown and transplanting

CENTER NAME: None - PMS office Baton Rouge, LA

REFERENCES: Godfrey 1988; USDA 1974, 1977

Castanopsis sempervirens (Kellogg) Dudley ex Merriam

SIERRA CHINKAPIN

CALIFORNIA CHINKAPIN

BRIEF DESCRIPTION OF NATIVE HABITAT: Rocky slopes, coniferous forest, chaparral; 2,275-10,700 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Data unavailable at date of publication.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Propagules were not stored for any significant time.

PROPAGATION METHOD: Cuttings received in flats were transplanted into cone cells in UCD mix of perlite, peat, vermiculite, sand, and Osmocote (50-50 peat/vermiculite mix had poor drainage). These were placed on bottom heat at 70°F soil temperature; misting was set for 4 seconds at 6-minute intervals, later changed to 4 seconds at 10-minute intervals. Potted cuttings received in cone cells were placed in lathhouse and fertilized with Osmocote. The latter, left in lathhouse for entire winter, had better performance than cuttings rooted in greenhouse. The results with cuttings were poor.

PRETREATMENT USED: Data unavailable at date of publication.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Castilleja Mutis ex L. f.

INDIAN PAINTBRUSH

BRIEF DESCRIPTION OF NATIVE HABITAT: Large genus of 150 to 200 species occurring mainly in western N. America. Several species occur in both Crater Lake and Mt. Rainier national parks.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Somewhat slow; seedheads small and seed begins to blow out as it matures.

METHOD OF CLEANING: Hammermill with 1/16" screen; air screen 1/21" round screen, very low air flow.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Not determined

PROPAGATION METHOD: None tried at PMC. Literature suggests planting with grass or other forb to provide roots for parasitism.

PRETREATMENT USED: None recommended.

METHOD OF GROWING: Castillejas are known to be at least partially parasitic.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted; identifying a particular species for harvest would be difficult since species occur together and are very difficult to distinguish, especially once flowering has passed.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Very small, light seed

RE-ESTABLISHMENT TECHNIQUES: Provide companion species (Emery 1988).

STATUS: Inactive; dropped from list of target species in revised SCS-Crater Lake National Park Cooperative agreement as of 1993.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Emery 1988; Hitchcock et al. 1969

Cathestecum erectum Vasey & Hack

FALSE GRAMA

BRIEF DESCRIPTION OF NATIVE HABITAT: Western Texas, southern Arizona, and northern Mexico; on dry plains and rocky slopes at low elevations.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed and plants

SEED MATURITY DATE: Possibly November

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Difficult

METHOD OF CLEANING: Shaker air-screen separation

STORAGE REQUIREMENTS: Undocumented--standard storage being used

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed and transplants

PRETREATMENT USED: None

METHOD OF GROWING: Direct seeding; transplanting on normally prepared listed beds; irrigation, fertilization, and cultivation.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Standard range-seeding methodology recommended for the Trans-Pecos region of Texas.

CENTER NAME: Knox City Plant Materials Center

REFERENCES: Gould 1978, 355.

Ceanothus fresnensis Dudley ex Abrams

F R E S N O M A T

BRIEF DESCRIPTION OF NATIVE HABITAT: Dry ridge in coniferous forest; 3,000-7,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings, seed

SEED MATURITY DATE: Quantitative values for date of maturity could not be found.

NUMBER OF SEED PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Hammered: 1/8" screen, 750 rpm; small clipper: screen size #8 & 1/2", air 100% open. Separation poor.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Propagules not stored for any significant time.

PROPAGATION METHOD: Cuttings: All leaves except one or two on top were cut off. Cuttings were then cut to approximately six inches in length, and each was dipped 1/2 inch into a hormone powder. The cuttings were then planted 3 or 4 nodes into the soil medium of 5 parts perlite to 1 part peat and placed in the greenhouse side table, directly on the bottom heating coils whose temperature was set at 70°. Misting was set for 4 seconds at 10-minute intervals. Greenhouse temperatures averaged 78° high and 62° low. The grow lights were on 14 hours each 24 hours. Due to some browning and drying of top leaves, misting was adjusted to keep leaf surface moist.

PRETREATMENT USED: Cuttings: two strengths of Hormex #16 and #3 were used. Seeds: 3 months cold stratification at 35° mixed with moist vermiculite in a sealed plastic bag.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Cephalanthus occidentalis L.

BUTTONBUSH

BRIEF DESCRIPTION OF NATIVE HABITAT: Buttonbush is found in swamps, sloughs, shallow ponds, and in and on the banks of small streams, marshes, and swamps (Godfrey 1988). Widespread in Louisiana in wet habitats (Brown 1965).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Flowers: June-Sept. Fruits: Sept.-October.

NUMBER OF SEEDS PER POUND: 136,000-320,000 (USDA 1974).

PERCENT GERMINATION: 96% (ibid.).

EASE OF COLLECTION: Readily accessible

METHOD OF CLEANING: Light flailing

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seeding in trays and transplanted

PRETREATMENT USED: None

METHOD OF GROWING: Container

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Container-grown and transplanting

CENTER NAME: None - PMS office Baton Rouge, LA

REFERENCES: Brown 1965; Godfrey 1988; USDA 1974

Cercocarpus ledifolius Nutt.

CURL LEAF MOUNTAIN MAHOGANY

BRIEF DESCRIPTION OF NATIVE HABITAT: "It characteristically grows in relatively pure stands in the higher elevations of the sagebrush zone, extending into juniper and pine woodlands...Seedlings often occur spontaneously on extremely harsh mine spoils" (Young and Young 1992, 98-100).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August-September

NUMBER OF SEEDS PER POUND: 48,200-56,600

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: "Collectors need to wear protective clothing and breathing and eye protection. Time of collection is critical as the fruits can be lost in a single windy day" (ibid.).

METHOD OF CLEANING: "Fruits may be passed through a hammer mill to remove the styles" (ibid.).

STORAGE REQUIREMENTS: "Seeds with moisture content of 7%-10% can be stored in ventilated containers" (ibid.).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Up to five years

PROPAGATION METHOD: Untreated seed can be sown into seed flats which can then be placed in cold stratification, or seed can be stratified before sowing. Seedlings can be transplanted from seed flats to growing containers.

PRETREATMENT USED: (Germination was obtained) "at a wide range of constant and alternating incubation temperatures by pre-chilling ...seeds in aerated solutions enriched with GA₃ and potassium nitrate for 3 weeks...Solutions of hydrogen peroxide as dilute as 3% were effective in breaking dormancy with corresponding prolonged soaking periods" (ibid.).

METHOD OF GROWING: A well-drained growing medium should be used to help prevent root rot. Seedlings respond well to a constant fertilization program, where approximately 100 ppm nitrogen, phosphorus, and potassium are applied with each watering.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Los Lunas Plant Materials Center

REFERENCE: Young and Young 1992

Chaenactis douglasii (Hook.) Hook. & Arn.

DUSTY MAIDEN

FALSE YARROW

BRIEF DESCRIPTION OF NATIVE HABITAT: Found on dry, exposed, coarse soils in Yellowstone; very common on obsidian sands.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/1 - 8/20

NUMBER OF SEEDS PER POUND: 375,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Relatively easy by cutting off entire seedhead.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B; difficult to remove scale-like pappus--seed remains bulky even after processing.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Viability good for up to 5 years.

PROPAGATION METHOD: Establish in cone-tainers, seed production plots.

PRETREATMENT USED: None

METHOD OF GROWING: Containerized material; seed production plots using hand stripping.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Very difficult to process down to a flowable seed.

RE-ESTABLISHMENT TECHNIQUES: Transplant cone-tainers; broadcast seeding of grass/forb mixtures, followed by raking.

CENTER NAME: Bridger, MT Plant Materials Center

NOTE: Research has been done on this plant because of suspected anti-carcinogenic properties in the plant and seed.

Chamaebatiaria millefolium (Torr.) Maxim.

FERNBUSH

BRIEF DESCRIPTION OF NATIVE HABITAT: Found in "Idaho south to New Mexico, Arizona, and California (common on both rims of the Grand Canyon), 4,500-7,000 feet, most common gravelly slopes...[Prefers] well-drained soil" (Phillips 1949, 101).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, division

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Data not available at date of publication.

METHOD OF CLEANING: Data not available at date of publication.

STORAGE REQUIREMENTS: Data not available at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data not available at date of publication.

PROPAGATION METHOD: "Seeds are very fine and should be sown on the soil surface" (ibid.). Unlike other species, fernbush seedlings have poor survival after the initial "bareroot" type transplanting from seedling flats to growing containers. To overcome this problem, the seed can be directly sown into the growing containers and thinned to one plant per cell. There were no problems in transplanting from small containers to larger containers.

PRETREATMENT USED: "Three months of cold, moist stratification is recommended" (ibid.).

METHOD OF GROWING: A well-drained growing medium should be used to help prevent root rot. Seedlings respond well to a constant fertilization program, where approximately 100 ppm nitrogen, phosphorus, and potassium are applied with each watering.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: "Responds well to periodic dilute nutrient applications, especially immediately after transplanting until plants are well established" (ibid.).

CENTER NAME: Los Lunas Plant Materials Center

REFERENCE: Phillips 1949

Chamaecrista fasciculata (Michx.) Greene

P A R T R I D G E P E A

BRIEF DESCRIPTION OF NATIVE HABITAT: Erect or spreading annual herb adapted to dry sandy sites from Massachusetts to Florida west to Minnesota and Texas.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August

NUMBER OF SEEDS PER POUND: 55,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Found along roadsides and power lines in Cape May County, NJ.

METHOD OF CLEANING: Air dry for one week in cloth bags; lightly run unshattered seed through a hammermill using screens with holes 2 times the seed size; mechanically clean with screens.

STORAGE REQUIREMENTS: After cleaning, store in dehumidified room @ <40°F in cloth bags.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Maximum storage period is unknown.

PROPAGATION METHOD: Spring field seeding in sandy loam at rate of 20 lbs. per acre. Weed control: cultivation and hand weeding. Irrigation: one inch bi-weekly.

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Hand pick pods to harvest all seed, or monitor for optimum seed maturity to mechanically harvest with combine.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Cultivate in fall after harvest to lightly cover shattered seed.

CENTER NAME: Cape May Plant Materials Center

Chrysothamnus nauseosus (Pallas ex Pursh) Britt.

R U B B E R R A B B I T B R U S H

G R A Y R A B B I T B R U S H

BRIEF DESCRIPTION OF NATIVE HABITAT: "Western North America: western Canada south to California, Texas, and northern Mexico, 3,000-8,000 ft., (in) dry, open areas, grassland, or open woodland, in dry washes...(Prefers) medium to coarse, alkaline soil" (Phillips 1949, 98).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, cuttings

SEED MATURITY DATE: October-November

NUMBER OF SEEDS PER OUNCE: 330,000 (uncleaned)

PERCENT GERMINATION: 20%-40%

EASE OF COLLECTION: Data not available at date of publication.

METHOD OF CLEANING: Screening and air screening

STORAGE REQUIREMENTS: "Storage at 4°C or -15°C protected viability of several species for as long as 8 years" (Young & Young 1992, 108).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Avg. two years (ibid.)

PROPAGATION METHOD: Seed: Is very small and should be sown on the soil surface of seed flats. Seedlings can be transplanted from seed flats to growing containers. Cuttings: "Take hardwood cuttings of previous year's new growth of greatest girth in spring before plants leaf out, dip in .8% IBA talc, and stick directly in a prepared bed outdoors. Keep dry for best results" (Phillips 1949, 99).

PRETREATMENT USED: None

METHOD OF GROWING: A well-drained growing medium should be used to help prevent root rot. Seedlings respond well to a constant fertilization program, where approximately 100 ppm nitrogen, phosphorus, and potassium are applied with each watering.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: "Once established, periodic deep watering, especially during hot weather, encourages leafiness without forcing rank growth" (Phillips 1949, 99).

CENTER NAME: Los Lunas Plant Materials Center

REFERENCES: Phillips 1949; Young and Young 1992

Coreopsis lanceolata L.

L A N C E - L E A V E D C O R E O P S I S

BRIEF DESCRIPTION OF NATIVE HABITAT: Ontario to Virginia, south to Florida and east to Missouri. Found in dry to moist soils growing in full sun to partial shade.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: July - August

NUMBER OF SEEDS PER POUND: 175,000-250,000 PLS/lb.

PERCENT GERMINATION: >90%

EASE OF COLLECTION: Seed falls from head when mature

METHOD OF CLEANING: Initial collection: seed cleaned by hand. 1992 production: cleaned by screening in a clipper.

STORAGE REQUIREMENTS: 40°F, 35% RH in polyethylene bags or sealed containers

ESTIMATED PROPAGULE STORAGE POTENTIAL: > 2 years

PROPAGATION METHOD: Seed

PRETREATMENT USED: None; germinates readily

METHOD OF GROWING: Sow in trays; transplant to cells for plug production, then transplant to the field. Growing well in open, sunny area on well-drained soil.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: 1992 production: stems with mature seed cut from the plants and spread on tarps to dry; seed shaken from seed heads; cleaned by screening in a clipper.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Because all the seed does not mature at the same time, there is a large percentage of unusable seed. Proper cleaning of seed can reduce this problem significantly.

RE-ESTABLISHMENT TECHNIQUES: 1993: Plugs grown in Ropak Multi-pots for planting in areas already covered with exotic vegetation (highway mix).

CENTER NAME: National Plant Materials Center

Coreopsis tinctoria Nutt.

PLAINS COREOPSIS

CALLIOPSIS

BRIEF DESCRIPTION OF NATIVE HABITAT: "Moist ground from Minnesota to Washington and southward to Louisiana and California; elsewhere escaped from gardens" (Rickett 1966, 2:448-49).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Early July

NUMBER OF SEED PER POUND: 1,400,000

PERCENT GERMINATION: 50% (one lot tested)

EASE OF COLLECTION: Seeds are small, and their collection is time-consuming though not particularly difficult.

METHOD OF CLEANING: Seed may be cleaned with an air-screen cleaner.

STORAGE REQUIREMENTS: Cool, dry conditions.

ESTIMATED PROPAGULE STORAGE POTENTIAL: 2 to 3 years.

PROPAGATION METHOD: Seed

PRETREATMENT USED: None

METHOD OF GROWING: Apply 3-4 lbs. of seed per acre on or near the soil surface on a firm seedbed or in a closely mowed, untilled area in July or August. No herbicide has been used. A light application of a complete fertilizer is beneficial. Tillage seems detrimental to the plants.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None. Direct combine.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None. May be cleaned with air screen or possibly other seed cleaners.

RE-ESTABLISHMENT TECHNIQUES: Limited experience indicates that seed production fields may need to be reseeded following seed harvest, particularly when harvested in an early stage of seed maturity.

CENTER NAME: James L. Whitten Plant Materials Center

REFERENCE: Rickett 1966.

Cornus canadensis L.

BUNCHBERRY DOGWOOD

BRIEF DESCRIPTION OF NATIVE HABITAT: Moist woods in northern North America, mountains of New Mexico and Calif.; also Greenland, east Asia. In Mt. Rainier National Park, at low elevations (below 4,000 ft.) in understory of firs and hemlocks.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Fleshy berries (for seed)

SEED MATURITY DATE: Late August to early September

NUMBER OF SEEDS PER POUND: Avg. 67,000 (range 59,000-77,000)

PERCENT GERMINATION: over 90%, with 6 months stratification

EASE OF COLLECTION: Berries easily identified and gathered; plants often occur in large patches, but berry production was nearly nonexistent due to drought and heat in 1992.

METHOD OF CLEANING: Berries processed in blender with water, using dulled blade; pulp strained off, seeds dried on paper toweling. Remaining dried pulp gently rubbed off and blown off dried seed.

STORAGE REQUIREMENTS: Cool/dry (fresh seed may respond better to stratification).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Plant stratified seed into containers with about a 15-mm. layer of native duff/soil at surface.

PRETREATMENT USED: Warm-moist stratification 45 days, followed by cold-moist for 140 days.

METHOD OF GROWING: Protect established plants from fungal root-rot with "Subdue" or other fungicides. Inspect roots carefully for root-damaging insects, grubs; control with parasitic nematodes (BioSafe or Exhibit).

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Collect soil and duff from native stands to provide mycorrhizal inoculum.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Container-grown transplants are planned for reestablishment at Mt. Rainier.

CENTER NAME: Corvallis Plant Materials Center

Cornus drummondii C.A. Mey.

ROUGH-LEAF DOGWOOD

BRIEF DESCRIPTION OF NATIVE HABITAT: Low woods and swamp forests (Radford et al. 1978).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Flowers: April-May. Fruits: August-October (USDA 1974).

NUMBER OF SEEDS PER POUND: 15,700 (stones)

PERCENT GERMINATION: 89% (USDA 1974)

EASE OF COLLECTION: Readily accessible

METHOD OF CLEANING: Hand stripping, then spread out in shallow layers to prevent excessive heating (if not cleaned). Stones can be extracted by macerating the fruit in water or running them through a hammermill, allowing the pulp and empty stones to float away.

STORAGE REQUIREMENTS: Seed should be cleaned to reduce pulp bulk. Clean, air-dried stones may be stored in sealed containers at 38°-41°F (ibid.).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Limited data indicates that stones may be stored for 2 to 4 years.

PROPAGATION METHOD: Seeding transfer to containers

PRETREATMENT USED: Seeds of all species show delayed germination due to dormant embryos; in most species, hard pericarps also are present. Warm stratification for at least 60 days in a moist environment followed by a longer period at a much lower temperature is required. Immersion in concentrated sulfuric acid for 1 to 3 hours or mechanical scarification can be used in place of warm stratification. Soaking stones in gibberellic acid for 24 hours has also been successful with *C. drummondii* (ibid.).

METHOD OF GROWING: Seeding transfer to containers

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Container-grown and transplanting

CENTER NAME: None - PMS office Baton Rouge, LA

REFERENCES: Radford et al. 1978; USDA 1974.

Cretaegus viridis L.

GREEN HAWTHORNE

BRIEF DESCRIPTION OF NATIVE HABITAT: Alluvial woods and swamp forests

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Scion wood cuttings for grafting; rootstock obtained from nursery.

SEED MATURITY DATE: Flowers: March-May. Fruits: Sept.-Oct.

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: All *Crataegus* species have embryo dormancy and require treatment in a moist medium at low temperatures (USDA 1974).

EASE OF COLLECTION: Moderately difficult.

METHOD OF CLEANING: Fruit should be spread out in thin layers to avoid excessive heat if prompt extraction is not possible. Nutlets are readily extracted by macerating ripe fruits in water. Thorough air drying of nutlets is necessary before storage (ibid.).

STORAGE REQUIREMENTS: Limited tests indicate that dry nutlets can be stored for 2 or 3 years if kept at 41°F, but optimum storage requirements have not been determined (ibid.).

ESTIMATED PROPAGULE STORAGE POTENTIAL: See discussion above.

PROPAGATION METHOD: Seeding and grafting

PRETREATMENT USED: Cold stratification prior to planting

METHOD OF GROWING: Seedbeds and container

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Green Hawthorneres develop a long taproot early and should not be kept in seedbeds more than a year.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Container-grown and transplanting

CENTER NAME: None - PMS office Baton Rouge, LA

REFERENCES: USDA 1974

Danthonia californica Boland

C A L I F O R N I A O A T G R A S S

BRIEF DESCRIPTION OF NATIVE HABITAT: Moist, open sites; meadows, forest; > 6,500 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, division

SEED MATURITY DATE: Quantitative values for date of maturity could not be found.

NUMBER OF SEEDS PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: (1990) Hammered once using size 1/12" screen at 750 rpm; cleaned on small clipper, one run using 1/16" X 1/4" top and blank on bottom, air closed.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Division: Plants (delivered during first part of September) were irrigated and lightly fertilized with 16-20-0 as needed; were moved from the lathouse to the greenhouse in January (following dormancy period). Plants were carefully divided by hand; potted plants were divided into plants with a single root system and placed into a vitamin B-1 solution. Plants, placed in Ray Leach cone-tainers in greenhouse for 2 weeks, were kept moist to wet with time-controlled misters and air temperature maintained at 65°-70°F. They were then moved to lathhouse. Seed: Time-controlled misters were used in the greenhouse and air temperature was maintained at 65°-70°F.

PRETREATMENT USED: Divisions: Vitamin B-1 solution for 15 minutes. Seed: none required.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Danthonia compressa Austin ex Peck

MOUNTAIN OATGRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Maine to New York, south to North Carolina and Tennessee. Found in woods growing in shady, well-drained sites.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED Maturity DATE: None

NUMBER OF SEEDS PER POUND: 400,000

PERCENT GERMINATION: >90%

EASE OF COLLECTION: Easy

METHOD OF CLEANING: Screening

STORAGE REQUIREMENTS: 40°F, 35% RH in paper envelopes

ESTIMATED PROPAGULE STORAGE POTENTIAL: At least 3 years

PROPAGATION METHOD: Seed

PRETREATMENT USED: None

METHOD OF GROWING: Sow in flats in the greenhouse; transplant to plugs, then to the field. Did not grow well in open sun; transplanted to a shadier site in fall 1992. Roots grow quite shallow.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Has not seeded at NPMC.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: None

CENTER NAME: National Plant Materials Center

Danthonia compressa Austin ex Peck

MOUNTAIN OATGRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Meadows, open woods, open ground in moist or dry woods. It was collected along paths or open areas where little or no other vegetation was competing. At the GSMNP, this species is found at high and low elevations from Quebec to Georgia, mostly in the Appalachian Mountains.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, vegetative material

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Collected by hand stripping plants. Seed is small and light. Seed ripening is uneven and seed shatters readily at maturity. Plants collected vegetatively were pulled or dug from site, divided into smaller planting units, and transplanted directly to the field in April 1992. Seed collection is very time-consuming and quality of seed is questionable. Large amounts of seed are limited in the Park.

METHOD OF CLEANING: Hammermill, clipper fanning mill, food blender, and hand screens.

STORAGE REQUIREMENTS: Unknown. Seed was stored in airtight containers in cold storage (relative humidity <50% temp <50°F).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed, vegetative transplants. Seed was directly sown to field in September and August 1990 and 1991, respectively. Germination was spotty, and stand poor. Vegetative transplants in 1992 had excellent survival. Propagation from seed in the greenhouse for transplanting to the field is being attempted in 1993. Germination has been poor. Seed was also planted 8-13-92 in the field.

PRETREATMENT USED: None

Danthonia compressa

MOUNTAIN OATGRASS (cont.)

METHOD OF GROWING: From seed: seed was planted at 80 seeds (bulk)/linear foot in 42-inch spaced rows using a Planet Jr. (Plate planter). Seeding was not successful. Attempts to seed with a belt seeder were also unsuccessful as seed did not drop properly. Seed planted 8-13-92 by hand had fair germination. Plants were very small at freeze-up. Soil washing due to excess rain covered many of the seedlings in the fall of 1992. Seedlings are very shallow-rooted and noncompetitive. Weeds may compete severely with this species.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Field size is very small at this time at the QPMC. Seed has been harvested by hand stripping at various times because of the uneven ripening.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Seed is difficult to clean because of its small size and light, chaffy seedhead material. Large lots of seed may allow for the use of a huller, which would make cleaning easier.

RE-ESTABLISHMENT TECHNIQUES: No unique techniques have been determined.

CENTER NAME: Quicksand Plant Materials Center

Danthonia intermedia Vassey

O A T G R A S S

BRIEF DESCRIPTION OF NATIVE HABITAT: Newfoundland and Quebec to Alaska, south to northern Michigan, New Mexico, and California. Meadows and bogs, northern and alpine regions.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August to September

NUMBER OF SEEDS PER POUND: 532,000

PERCENT GERMINATION: 79%

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: Up to 5 years under cool, dry conditions.

PROPAGATION METHOD: Seed

PRETREATMENT USED: 30- to 60-day stratification may be beneficial.

METHOD OF GROWING: Direct plant. Fall seed.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Information unavailable

RE-ESTABLISHMENT TECHNIQUES: Direct plant. Fall seed.

CENTER NAME: Meeker Plant Materials Center

Dicentra formosa (Andr.) Walp.

PACIFIC BLEEDINGHEART

BRIEF DESCRIPTION OF NATIVE HABITAT: Moist woods, western B.C. south to central Calif.; from coast to middle elevations (Hitchcock et al. 1969). Our collections were made at Crater Lake, 5,000-6,500 ft.; occasional clusters of plants at base of rocky cliffs; gravelly areas near seeps, streams.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August - early September

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: 0%

EASE OF COLLECTION: Pods easily identified and collected from clusters of plants; no sizeable patches of bleeding heart were found at any one location.

METHOD OF CLEANING: Hammermill, 1/8" screen, air screened with #6 round screen, low air flow.

STORAGE REQUIREMENTS: Not determined; ours were stored cool, dry. May require special storage to retain viability.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Not known; may be very short: one-year-old seeds were tested with TZ and found to be 0% viable.

PROPAGATION METHOD: Not determined; seed propagation efforts were unsuccessful.

PRETREATMENT USED: 48 days cold-moist stratification. Exhibited little or no germination.

METHOD OF GROWING: Data unavailable at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Could be dug up for vegetative division, but could not be obtained this way in any quantity without decimating the stand or cluster.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data unavailable at date of publication.

STATUS: Inactive--dropped from revised SCS-Crater Lake National Park cooperative agreement as of 1993.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Diospyros virginiana L.

PERSIMMON

BRIEF DESCRIPTION OF NATIVE HABITAT: Usually dry deciduous forest, pinelands, and old fields; however, has a wide range of sites varying in moisture and fertility conditions (Godfrey 1988).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed and seedlings

SEED MATURITY DATE: Flowers: March-June. Fruits: Sept.-November.

NUMBER OF SEEDS PER POUND: 1,200 (USDA 1974)

PERCENT GERMINATION: 96% (ibid.)

EASE OF COLLECTION: Readily accessible

METHOD OF CLEANING: Seeds are easily removed by running water through a macerator and allowing the pulp to float away, or by rubbing and washing the pulp through 1/4-inch mesh hardware cloth (ibid.).

STORAGE REQUIREMENTS: Cleaned seed should be spread out to dry for a day or two. Prolonged storage requires thorough drying (ibid.).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Unknown; however, seeds stored for prolonged periods should be stored in sealed, dry containers at 41°F (ibid.).

PROPAGATION METHOD: Seed and seedlings

PRETREATMENT USED: Cold stratification at 40°F for 90 days

METHOD OF GROWING: Container

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Seedlings have strong taproots and should be field planted at the end of the first season.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Container-grown and transplanting

CENTER NAME: None - PMS office Baton Rouge, LA

REFERENCES: Godfrey 1988; USDA 1974

Diospyros virginiana L.

PERSIMMON

BRIEF DESCRIPTION OF NATIVE HABITAT: Southern Pennsylvania west to east Kansas, and south to Florida and eastern Texas.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September to November

NUMBER OF SEEDS PER POUND: At NPMC, 1300 PLS/lb; lit. range 680-1750/lb. (U.S. Dept. of Agric. 1974).

PERCENT GERMINATION: "Seldom exceeds 60%" (Young and Young 1992, 135); at NPMC (1992), 50%.

EASE OF COLLECTION: Collected from ground.

METHOD OF CLEANING: Animals left clean seed at the collection site.

STORAGE REQUIREMENTS: 40°F, 35% RH in closed polyethylene bags

ESTIMATED PROPAGULE STORAGE POTENTIAL: Several years

PROPAGATION METHOD: Seed

PRETREATMENT USED: 86 days cold, moist stratification

METHOD OF GROWING: Plant pretreated seed directly in the field.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Spring 1993: seedlings will be dug from the seedbed with a tractor-mounted U-blade digger.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Keep plants moist as they may be difficult to transplant bare root. If bare-root production does not work well, container production will be used in the future.

RE-ESTABLISHMENT TECHNIQUES: 1993: Bare-root transplanting. Survival data not available yet.

CENTER NAME: National Plant Materials Center

REFERENCE: U.S. Dept. of Agriculture 1974; Young and Young 1992, 134-35.

Dracopsis amplexicaulis (Vahl) Cass.

CLASPING CONE FLOWER

BRIEF DESCRIPTION OF NATIVE HABITAT: Occurs in abandoned fields, along roadsides, and in idle areas in an early stage of ecological succession, often on moist soil areas.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: July

NUMBER OF SEED PER POUND: 950,000

PERCENT GERMINATION: 44% (one test)

EASE OF COLLECTION: Seed shatters readily from mature seedheads, making time of collection important. One full staff-day of hand collection might yield between 2-3 lbs. of clean seed.

METHOD OF CLEANING: Air-screen cleaner

STORAGE REQUIREMENTS: Dry, cool conditions

ESTIMATED PROPAGULE STORAGE POTENTIAL: Unknown, but probably several years.

PROPAGATION METHOD: Direct seeding into field.

PRETREATMENT USED: None

METHOD OF GROWING: Fields have been planted in 38-inch-wide rows in a prepared seedbed, planting about 1 lb. of seed per acre very shallow. Germination and establishment was poor. A broadcast application of probably 2-3 lbs. per acre onto a very firm seedbed or mowed, untilled area provides a better stand.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Seed can be direct combined. Fields must be watched to time harvest such that the greatest number of seeds are mature and before excess shattering occurs.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Production fields of clasping coneflower, an annual, appear to reseed themselves with shattered seed and without any management except being mowed 4-6 in. high in summer and fall following harvest of seed.

CENTER NAME: James L. Whitten Plant Materials Center

Dryas drummondii Richards. ex Hook.

Y E L L O W D R Y A D

BRIEF DESCRIPTION OF NATIVE HABITAT: Exposed gravelly slopes

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, transplants, cuttings

SEED MATURITY DATE: 8/5 - 8/15

NUMBER OF SEEDS PER POUND: 908,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Relatively easy because of extensive colonization of some road cuts.

METHOD OF CLEANING: Thresh with hammermill. Because of woody appendages, very difficult to process; mixing with rice hulls creates more abrasion in hammermill.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Viability good for 3 to 5 years.

PROPAGATION METHOD: Transplanting containerized material most successful.

PRETREATMENT USED: None

METHOD OF GROWING: Because of extensive layering, many transplants can be developed from a single plant.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Potted transplants; some direct seeding

CENTER NAME: Bridger, MT Plant Materials Center

Elymus elymoides (Raf.) Swezey
(Sitanion hystric (Nutt.) J.G. Sm.)

BOTTLEBRUSH SQUIRRELTAIL

BRIEF DESCRIPTION OF NATIVE HABITAT: Coast to inland desert plains, prairies; mountains to above treeline; dry-rocky to moist areas. B.C. and Alberta to southern Calif., New Mexico, and Arizona, east to S. Dakota, and south to Texas (Hitchcock et al. 1969).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August to early September in parks; June to early July at Corvallis.

NUMBER OF SEEDS PER POUND: Approximately 190,000

PERCENT GERMINATION: 48%-60%; additional 5%-10% dormant seed revealed by TZ testing.

EASE OF COLLECTION: Hand harvested; easily identified. Collection is slowed because of long, wavy awns; seed heads "fluffy," have to be scrunched down in containers. Seed set variable: very little seed developed at parks or PMC in the hot, dry summer of 1992.

METHOD OF CLEANING: De-awned with brush machine, #12 mantle, 1/8" brush clearance. Air-screened in 2 runs: first run with 1/12" X 1/2" screen, followed by 1/14" X 1/4" screen with high air flow.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Three or 4 years; older lots of squirreltail seem to lose viability faster than the related blue wild rye, which has been stored under the same conditions.

PROPAGATION METHOD: Direct seeded into field or in cone-tainers, spring or fall.

PRETREATMENT USED: None

Elymus elymoides (Sitanion hystrix)

BOTTLEBRUSH SQUIRRELTAIL (cont.)

METHOD OF GROWING: Seed increase fields subject to rust; controlled with Tilt fungicide. Weed control is a serious problem: 2,4-D used to control broadleaf weeds; spot-spraying and band weeding used to control contaminant weedy grasses. Stands at PMC are short-lived; plant vigor and seed production falls off sharply after two years. One section of field was burned after harvest in 1992; full regrowth appeared to be more vigorous and vigor is still evident as of May 1993. Plants do not reach same stature as in native stands. Squirreletail appears to be very poorly adapted to conditions at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Seed shatters easily at maturity; timing of harvest or windrowing critical. Machine harvesting difficult due to large amount of "trash" and short seedhead stalks at Corvallis (especially in older stands of lower vigor).

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Long awns make seed slow and difficult to process.

RE-ESTABLISHMENT TECHNIQUES: Fall seeding; or fall transplanting of container-grown plugs, planned in lieu of sufficient seed increase at the Corvallis PMC. This species has been successfully used in reclamation plantings in other areas of the West (Montana, Utah) by fall seeding.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969. Literature review was included in the 1992 Soil Conservation Service Plant Materials Report on National Park Service Projects.

Elymus glaucus Buckl.

BLUE WILDRYE

BRIEF DESCRIPTION OF NATIVE HABITAT: Prairies, open woods, dry to moist hillsides, coast to mid-montane; Alaska to southern Calif., east to Ontario, Mich., and Iowa, south to Colorado and New Mexico (3 variants all occur in Oregon, freely intergrading) (Hitchcock et al. 1969). In Mt. Rainier and Crater lake national parks, along roadsides, in meadows and hillsides. Our collections up to 7,000 ft. at Crater Lake.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: 124,000-155,000

PERCENT GERMINATION: Most lots have averaged over 90% germ. in the first year, gradually declining to about 60% after 3 years. Older lots (from non-park service collections) have retained moderate viability (30%-50% germ.) after 4 to 5 years.

EASE OF COLLECTION: Hand harvested; can use hand sickle on larger, solid stands. Easily identified. Seed shatters at maturity but will ripen into viable seed if harvested at soft to hard dough stage.

METHOD OF CLEANING: Hammermill with 3/16" screen, scalp with air screen, #14 screen (to remove awns), rescreen with 1/14" X 1/4" screen, medium-high air flow. Larger lots may be de-awned with a brush machine or debearder instead of hammermill.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Four to 5 years, possibly longer in controlled low-temperature, low-humidity conditions.

PROPAGATION METHOD: Direct seeding, spring or fall. Bunch-type grass, does not spread through rhizomes or stolons. Seeding rate of 50 pure live seed per foot provides good stands.

PRETREATMENT USED: None

Elymus glaucus

BLUE WILD RYE (cont.)

METHOD OF GROWING: Weed control is most critical during seedling establishment. Broadleaf weeds can be controlled with 2,4-D, but control of weedy grasses is limited to hand weeding and spot-spraying with a general herbicide such as Paraquat or Round-up. At the Corvallis PMC, annual bluegrass has been the most serious weedy grass, and has been most successfully controlled by applying Paraquat to field in January or early Feb., when blue wild rye is winter-dormant. Tilt fungicide is applied during spring to control rust. Ergot can be a problem in both native stands and increase fields: no seed treatments are approved for blue wild rye, so the only control measure available is to plant clean seed only.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Immature seed develops to maturity after harvesting better than many grass species.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Seeds should be well-dried to break off awns. Belt-seeder may be used to plant seeds that are not completely de-awned.

RE-ESTABLISHMENT TECHNIQUES: Fall seeding planned for Crater Lake and Mt. Rainier. First-year results of revegetation study at Crater Lake showed that blue wild rye produced fairly high seedling density in spring. Straw mulch reduced emergence and plant cover percentage; slow-release fertilizer and organic soil amendment (peat moss) produced the highest percent plant cover. Additional data collection is planned for these plots in 1994. Three ecotypes of blue wild rye were included in the revegetation study plots at Mt. Rainier installed in the fall of 1992. Data on plant emergence and establishment will be collected in 1993 and 1994.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969; literature review continuing at Corvallis PMC.

Elymus glaucus Buckl.

BLUE WILDRYE

BRIEF DESCRIPTION OF NATIVE HABITAT: Open areas, chaparral, woodland, forest; > 7,500 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Late June

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: 91%

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Seed cleaned using 47-B clipper using top screen, 1/14 X 1/4; middle screen 1/16 X 1/4; bottom screen 1/14; at 100% air full open. Hammered with 1/4" screen at 700 RPM.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Was planted at the PMC as field seed increase.

PRETREATMENT USED: None required.

METHOD OF GROWING: Planted at a seeding rate of 10.5 pounds per acre, 30" rows (the two-acre stand seeded on 2-15-89 was rated as excellent). This species was established using standard methods, i.e., disking, land leveling, furrows, planting with drill, fertilizing, cultivating, and spraying for weed control, and irrigation. This stand demonstrated that high elevation blue wildrye grass seed can be produced in large quantities at 100' elevation in the Mediterranean climate.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: (In both 1990 and 1991) Harvested with three passes with a flail-vac harvester at 300 RPMs; in 1990, 120 pounds were bulk-harvested, which yielded 43 PLS pounds (21.5 PLS pounds/acre), 91% germination, 99.89 purity. In 1991, 558 pounds were harvested, which yielded 250 pounds of clean seed; the seed test results are not in at this time. The pesticides used on this stand are MCPP with Buctril and Redeem.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data unavailable at date of publication.

CENTER NAME: Lockeford Plant Materials Center

Elymus salinus M.E. Jones

SALINA WILDRYE

BRIEF DESCRIPTION OF NATIVE HABITAT: Wyoming, Idaho, Utah, and Arizona. Rocky slopes and sagebrush hills, steep mountain slopes; gravelly to clayey, moderately alkaline soil; 5,200-8,500 ft. elevation; 10-16 in. precipitation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Mid to late July

NUMBER OF SEEDS PER POUND: 130,000

PERCENT GERMINATION: 30%-70% (usually between 30% and 40%)

EASE OF COLLECTION:

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: Short-lived seed (est. 2 to 3 years).

PROPAGATION METHOD: Seed

PRETREATMENT USED: 30-day cold/moist stratification

METHOD OF GROWING: Direct plant seed approximately 1/2-inch deep in medium textured soils. Drilling rate is 20 PLS per foot of row (about 40 bulk seed). Irrigation is used for seed production.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Direct seeded at 8-10 lb. PLS per acre.

CENTER NAME: Meeker Plant Materials Center

Elymus villosus Muhl. ex Willd.

HAIRY WILDRYE

BRIEF DESCRIPTION OF NATIVE HABITAT: Most areas east of the Rockies, in moist or dry woods and slopes.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Early September - early October

NUMBER OF SEEDS PER POUND: 76,000 (NPMC)

PERCENT GERMINATION: >95%

EASE OF COLLECTION: Seed remains on head for 1 to 2 weeks after maturity.

METHOD OF CLEANING: Hammermill, clipper

STORAGE REQUIREMENTS: 40°F, 35% RH in paper envelopes

ESTIMATED PROPAGULE STORAGE POTENTIAL: Excellent: >4 years.

PROPAGATION METHOD: Seed

PRETREATMENT USED: None, germinates readily. Warmer temperatures (>70°F) hasten germination.

METHOD OF GROWING: Sow in trays in the greenhouse; transplant to plugs, then transplant to the fields. Grows well in open sun on well-drained soil.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Hand cut stems and allow to dry on tarps; shake seed from seedheads, clean with hammermill and clipper.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: 1993: Plugs grown for establishment through existing exotic vegetation.

CENTER NAME: National Plant Materials Center

Ericameria bloomeri (Gray) J.F. Macbr.
(Haplopappus bloomeri Gray)

BLOOMER RABBITBRUSH

BRIEF DESCRIPTION OF NATIVE HABITAT: Dry rocky slopes, open woods, foothills to moderate elevations; south B.C., northeast Washington, Cascades, and mountains in eastern Oregon to Calif. (Hitchcock et al. 1969). Found at Crater Lake near rim, and on breaks above pinnacles on east side of park, growing with *Ribes cereum*, squirreltail, other dry-meadow forbs.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings, seed

SEED MATURITY DATE: Mid-September or later

NUMBER OF SEEDS PER POUND: Approximately 1,300,000

PERCENT GERMINATION: Not determined at PMC, but literature on other *Haplopappus* species reports 20% or less (due to immature embryos, empty seed).

EASE OF COLLECTION: Seed easily collected, in moderate amounts. Larger cuttings can be taken only in limited quantities without visually damaging plants.

METHOD OF CLEANING: Difficult because of hairy achenes; very light seed--hand rub and screen. Some seed will be planted with hairy pappus attached.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Cuttings were not successful. Seed propagation recommended with 0 to 3 months stratification (Emery 1988).

PRETREATMENT USED: Experimental: 0 to 3 months stratification in soil flats.

METHOD OF GROWING: Start seed in flats; transplant to one-gallon containers with well-drained soil mix.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Small, light, hairy seeds require careful handling.

RE-ESTABLISHMENT TECHNIQUES: Container transplanting in fall is planned for revegetation projects at Crater Lake.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Emery 1988; Hitchcock et al. 1969

Erigeron philadelphicus L.

PHILADELPHIA FLEABANE

BRIEF DESCRIPTION OF NATIVE HABITAT: Occurs along roadsides, fields, lawns, and other regularly mowed areas, particularly in stands of grasses.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Late April - early May

NUMBER OF SEED PER POUND: 3 to 4 million

PERCENT GERMINATION: Unknown, but low

EASE OF COLLECTION: Seed was collected by hand stripping seed from plants. Reasonably dense stands of up to 1/4 acre occur, so material for collection is available. Flowering and seed maturity is indeterminate, and seed shatter soon after ripening.

METHOD OF CLEANING: No satisfactory method has yet been found. Seeds are tiny, and the persistent pappus causes them to cling together in large clumps. Cleaning attempts through the use of an air-screen machine have been unsuccessful. No machine suitable to remove the pappus is available at the Whitten (Coffeeville) PMC.

STORAGE REQUIREMENTS: Unknown; probably cool, dry conditions.

ESTIMATED PROPAGULE STORAGE POTENTIAL: A few years

PROPAGATION METHOD: Seed

PRETREATMENT USED: None

METHOD OF GROWING: Direct seeding into a production field at a rate of 1/4-1/2 lb. per acre. Attempts at establishment by planting on or near the surface of a clean-tilled seedbed and surface planting into a mowed grass stand have been tried. Neither has produced acceptable stands of fleabane.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: A flail-vacuum machine is necessary for seed harvest, and even this has not been very satisfactory to date. Most seeds are blown from the machine.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Shattered seed seems to produce a sufficient stand around a few plants which were transplanted from stock grown in the greenhouse.

CENTER NAME: James L. Whitten Plant Materials Center

Eriogonum marifolium Torr. & Gray

WILD BUCKWHEAT

BRIEF DESCRIPTION OF NATIVE HABITAT: Gravelly flats in lodgepole and ponderosa forest to alpine talus and ridges up to 9,000 ft. elevation; Cascade Mts. from Oregon to N. Calif. (Hitchcock et al. 1969). Occurs in open meadows and on pumice flats at Crater Lake National Park, often with Hall's sedge, squirreltail, needlegrass, lupines, and other meadow forbs.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August- September

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: 14%-19% with no pretreatment on blotters; germination appears to be improved on soil.

EASE OF COLLECTION: Very easy to identify and collect--occur in large numbers in dry, open meadows at Crater Lake.

METHOD OF CLEANING: Hammermill with 1/8" screen; air screen 1/16" round screen, medium low air; ran two times to reduce amount of chaff.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Direct seed in cone-tainers.

PRETREATMENT USED: 48 days and 56 days cold-moist stratification

METHOD OF GROWING: Establish from seed in greenhouse; cones work well. Established plants were maintained in lathhouse over winter: all survived. Some flowering occurred the first season.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted. Special note: No plans for seed increase at PMC because the plant needs well-drained soil. However, seed is plentiful at Crater lake (at least, as observed in '92); may be possible to harvest native stands for reseeding.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Plans call for container-grown transplants to be planted in full for Crater Lakes reveg. projects.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Eupatorium L.

THOROUGHWORT
BONESET

BRIEF DESCRIPTION OF NATIVE HABITAT: Erect, branching perennial herb found on dry sandy sites from Long Island to Florida west to Arkansas.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed (large amounts of non-seed material are collected to ensure adequate harvest).

SEED MATURITY DATE: September - October; seed matures with the drying of the plant.

NUMBER OF SEED PER POUND: Data not available at date of publication.

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Seed was readily found on Assateague Island, MD. in the transition zone between the foredune and forests.

METHOD OF CLEANING: Feed collected material into a hammermill using small screening; follow with mechanical screen cleaning with no air.

STORAGE REQUIREMENTS: After cleaning, store in cloth bags in a dehumidified room @ <40°F.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

<u>PROPAGATION METHOD:</u>	<u>Field</u>	<u>Greenhouse</u>
Medium:	sandy loam	1:2 peat/sand
Rate:	15 lbs./ac	20 g./sq. ft.
Weed Control:	hand	hand
Irrigation:	1 inch/biweekly	kept moist

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Light, fibrous tufts are difficult to separate from seed.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Cape May Plant Materials Center

A P A C H E P L U M E

BRIEF DESCRIPTION OF NATIVE HABITAT: "West Texas west to California; Chihuahua, Mexico, north to Colorado... 3,000-8,000 ft...[Prefers] dry, gravelly, or sandy soil, but will tolerate most soil types as long as they are reasonably well drained and dry between waterings" (Phillips 1949, 95).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, cuttings, layering, division

SEED MATURITY DATE: Mid-spring and/or late summer

NUMBER OF SEEDS PER POUND: Approximately 420,000 (Phillips, 95); 54,000 (Vories in Nokes 1986, 190)

PERCENT GERMINATION: 30%-40% on average

EASE OF COLLECTION: Data not available at date of publication.

METHOD OF CLEANING: Rubbing and air-screening; however, "it is not necessary to remove the styles prior to sowing or storage" (Nokes 1986, 190).

STORAGE REQUIREMENTS: "Air-dry the seeds and store them in cloth or burlap bags in a dry, well-ventilated place" (ibid.).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Up to 3 years

PROPAGATION METHOD: Untreated seed can be sown into seed flats which can then be placed in cold stratification, or seed can be stratified before sowing. Seedlings can be transplanted from seed flats to growing containers. **Cuttings:** of very soft wood in spring or August-September, treated with 0.8-2.0% IBA talc, root reasonably well.

PRETREATMENT USED: Fresh seed requires none. "Dried or stored seeds must be stratified for 30 days at 41°F to break a delayed dormant condition" (Nokes, 191).

METHOD OF GROWING: A well-drained growing medium should be used to help prevent root rot. Seedlings respond well to a constant fertilization program, where approximately 100 ppm nitrogen, phosphorus, and potassium are applied with each watering.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: "Seeds can be sown in the Southwest either in the spring or during the summer rainy period. They should be covered with a thin layer of soil on a firm seedbed" (Young & Young 1992, 154).

CENTER NAME: Los Lunas Plant Materials Center

REFERENCES: Nokes 1986; Phillips 1949; Young and Young 1992

Festuca viridula Vasey

GREEN LEAF FESCUE

BRIEF DESCRIPTION OF NATIVE HABITAT: Occurs on alpine to subalpine slopes primarily in northwestern North America.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August to Sept. at Mt. Rainier; late June to early July at PMC.

NUMBER OF SEEDS PER POUND: 750,000

PERCENT GERMINATION: <1% without stratification; up to 45% germ. with 20 weeks cold-moist stratification.

EASE OF COLLECTION: Hand-harvested; sickle can be used to harvest from large clumps of established plants in park.

METHOD OF CLEANING: Air-screen (office clipper), #8 round screen, medium air stream. Some light/empty seed will be blown out during cleaning.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Containerized transplants were successfully produced by cold-stratifying seed for 16 weeks prior to planting in the greenhouse. Plants established from transplants appear to be more resilient.

PRETREATMENT USED: Germination is significantly enhanced by cold-moist stratification, or mechanical scarification if seed lot is one year old or less. In 1991, seeds cold-stratified for 20 weeks germinated to 45%; in 1992, result was 24% germination. In 1991, seeds scarified with Forsberg Huller scarifier germinated to 28%; in 1992, to 2%.

Festuca viridula

GREENLEAF FESCUE (cont.)

METHOD OF GROWING: Manual weed control consisted of hand weeding and/or roto-tilling where possible. Chemical weed control of broadleaves consisted of one or more applications of 2,4-D + Banvel. Chemical weed control of grasses and broadleaves between rows consisted of wicking Roundup, or spot-spraying with Roundup. For fields planted prior to 1992, ammonium nitrate (50 lbs N per acre) and sulfur (15 lbs S per acre) were applied in March and again in May; ammonium nitrate (25 lbs N per acre) was applied in December to all fields in production. For rust control, Tilt was applied to established fields in early March, late March, mid April, early May, and to all fields in late August; Bravo was added to spray to control leaf spot. Fungicides have not been effective at controlling (approx. 20% incidence of) crown rot.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Small clumps of plants transplanted from Sunrise Park to Corvallis PMC, established well at PMC.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Availability and duration of soil moisture was determined to be a critical factor in seedling establishment. Recommended procedures to enhance plant establishment in future seedings included tillage to aerate soil, increase water percolation and root penetration, and decrease wash-off of seeds. Fall seeding was recommended to ensure adequate moisture availability for early spring germination, and to provide natural seed stratification. See also *Lupinus latifolius*.

CENTER NAME: Corvallis Plant Materials Center

COMMENT: Full literature review included in 1992 SCS *Plant Materials Report on National Park Service Projects*.

Gaillardia Foug.

BLANKET FLOWER

The NPMC is no longer considering this species for production.

BRIEF DESCRIPTION OF NATIVE HABITAT: No longer considering this species for production.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: No longer considering this species for production.

SEED MATURITY DATE: No longer considering this species for production.

NUMBER OF SEEDS PER POUND: No longer considering this species for production.

PERCENT GERMINATION: No longer considering this species for production.

EASE OF COLLECTION: No longer considering this species for production.

METHOD OF CLEANING: No longer considering this species for production.

STORAGE REQUIREMENTS: No longer considering this species for production.

ESTIMATED PROPAGULE STORAGE POTENTIAL: No longer considering this species for production.

PROPAGATION METHOD: No longer considering this species for production.

PRETREATMENT USED: No longer considering this species for production.

METHOD OF GROWING: No longer considering this species for production.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: No longer considering this species for production.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: No longer considering this species for production.

RE-ESTABLISHMENT TECHNIQUES: No longer considering this species for production.

CENTER NAME: National Plant Materials Center

Gaillardia aristata Pursh

COMMON BLANKETFLOWER

BRIEF DESCRIPTION OF NATIVE HABITAT: Open meadows and parks in lower level forests and open rangeland; found as pioneer species on disturbed coarse soils.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/1 - 8/25

NUMBER OF SEEDS PER POUND: 153,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Large cone-heads easy to hand pick.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Good viability for up to 5 years.

PROPAGATION METHOD: Establish in cone-tainers; establish seed production rows.

PRETREATMENT USED: None

METHOD OF GROWING: Hand harvest of seedheads from production rows.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Broadcast seed in grass/forb mixture; transplant containerized material.

CENTER NAME: Bridger, MT Plant Materials Center

Geranium viscosissimum Fisch. & C.A. Mey. ex C.A. Mey.

STICKY GERANIUM

BRIEF DESCRIPTION OF NATIVE HABITAT: Open parks and meadows in lodgepole pine/Douglas fir habitat types.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August and September

NUMBER OF SEED PER POUND: 45,000

PERCENT GERMINATION: >40% in limited trials

EASE OF COLLECTION: Collecting is time-consuming because there are only 2-5 seeds per flower.

METHOD OF CLEANING: Hammermill to M2B to office clipper.

STORAGE REQUIREMENTS: Data not available at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data not available at date of publication.

PROPAGATION METHOD: Direct seed into containers.

PRETREATMENT USED: None; direct seeding without any cold chilling period produced >40% germination. Cold chilling may improve results but not tested to date.

METHOD OF GROWING: Cone-tainers in greenhouse; extra fine commercial peat:perlite mix.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Bridger, MT Plant Materials Center

Geum triflorum Pursh

PRAIRIESMOKE

BRIEF DESCRIPTION OF NATIVE HABITAT: Open meadows and parks, well-drained sites.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 7/20 - 8/10

NUMBER OF SEEDS PER POUND: 696,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Plants are usually scattered; easy to hand-pick.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Good viability for at least 3 years.

PROPAGATION METHOD: Seed in grass/forb mixtures (direct seed or seed in flats for transplanting).

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Direct seeding or transplant of seeded flats.

CENTER NAME: Bridger, MT Plant Materials Center

Glyceria elata (Nash ex Rydb.) M.E. Jones

TALL MANNAGRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Wet meadows, springs, and shady moist woods, Montana to B.C., south in the mountains to New Mexico and California" (Hitchcock 1971).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Not for propagation. 5 g. collected in 1990 for possible preliminary observations; Park Service decided not to pursue work on this species.

EASE OF COLLECTION: Park Service decided not to pursue work on this species.

METHOD OF CLEANING: Park Service decided not to pursue work on this species.

STORAGE REQUIREMENTS: Park Service decided not to pursue work on this species.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Park Service decided not to pursue work on this species.

PROPAGATION METHOD: Park Service decided not to pursue work on this species.

PRETREATMENT USED: Park Service decided not to pursue work on this species.

METHOD OF GROWING: Park Service decided not to pursue work on this species.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Park Service decided not to pursue work on this species.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Park Service decided not to pursue work on this species.

RE-ESTABLISHMENT TECHNIQUES: Park Service decided not to pursue work on this species.

CENTER NAME: Corvallis Plant Materials Center

Hamamelis virginiana L.

COMMON WITCH-HAZEL

BRIEF DESCRIPTION OF NATIVE HABITAT: Witch-hazel occurs as an understory plant under old-growth hardwood stands, and at some forest edges. It is found most often on the slopes above streams and drains. This species is not tolerant of either wet sites or the very dry sites on ridge tops.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Both seed and root suckers have been collected.

SEED MATURITY DATE: Early autumn (Young & Young 1992, 175)

NUMBER OF SEEDS PER POUND: Approximately 8,600-10,900 (Young & Young 1992, 174)

PERCENT GERMINATION: Over 50% (one planting)

EASE OF COLLECTION: Seeds are very difficult to locate in our collection area. Those found are hand harvested. Root suckers require a considerable amount of labor to locate, dig, and pot.

METHOD OF CLEANING: Seed capsules are allowed to dry, and most seeds are expelled. Those remaining are removed by hand. Seed can then be screened to remove capsules and trash.

STORAGE REQUIREMENTS: Store dry seed in sealed containers at 41°F (U.S. Dept. of Agriculture 1974).

ESTIMATED PROPAGULE STORAGE POTENTIAL: 1 year (ibid.)

PROPAGATION METHOD: Fall sowing of seed has resulted in good spring germination. Young and Young (1992) mention a procedure for stratifying seed in moist peat at 20°C for 8 weeks, and then continuing with 20 weeks at 4°C.

PRETREATMENT USED: Data unavailable at date of publication.

METHOD OF GROWING: Seedlings produced as above are transplanted into a good growing medium in containers and grown 1 to 2 years as appropriate. Root suckers are transplanted and grown as for seedlings.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Data unavailable at date of publication.

CENTER NAME: James L. Whitten Plant Materials Center

REFERENCES: U.S. Department of Agriculture 1974; Young and Young 1992

Hamamelis virginiana L.

COMMON WITCH-HAXEL

BRIEF DESCRIPTION OF NATIVE HABITAT: Maine to Wisconsin and south to Florida and Alabama. Understory woodland tree adapted to a wide range of conditions.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed capsules, collected before capsules open

SEED MATURITY DATE: September - October

NUMBER OF SEEDS PER POUND: 8,500-11,000

PERCENT GERMINATION: Unknown, though usually low

EASE OF COLLECTION: Easy, though time consuming because capsules must be hand picked.

METHOD OF CLEANING: Capsules placed in paper bag and put in warm location for 2 to 3 weeks to allow capsules to open and seed to be ejected. Screen out Seed by hand.

STORAGE REQUIREMENTS: 40°F, 35% RH in paper envelopes

ESTIMATED PROPAGULE STORAGE POTENTIAL: 1 to 2 years

PROPAGATION METHOD: Seed

PRETREATMENT USED:

1992: 86 days cold, moist stratification, then planted in pots; all plantings failed.

1993: a) 3 months warm stratification, followed by 3 months cold stratification (Dirr & Heuser 1987);

b) 40 min. H₂SO₄, followed by 2 months warm then 3 months cold;

c) 40 min. H₂SO₄, followed by 1 month warm then 2 months cold;

d) 40 min. H₂SO₄, followed by 3 months cold. Test results not available yet.

METHOD OF GROWING: Germinate in pots--all plantings failed in 1992.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Harvest fruit capsules before dehiscence takes place.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: None

CENTER NAME: National Plant Materials Center

REFERENCE: Dirr & Heuser 1987

NORTHERN SWEETVETCH

BRIEF DESCRIPTION OF NATIVE HABITAT: Exposed hillsides or understory of open ponderosa pine savannas.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED Maturity DATE: 7/25 - 8/10

NUMBER OF SEEDS PER POUND: 125,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Easily hand stripped but timing is very critical.

METHOD OF CLEANING: Thresh with hammermill--smaller seed may not readily thresh out of loment pod (may be left in loments).

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Hard legume seed may be stored for up to 10 years.

PROPAGATION METHOD: Seeding

PRETREATMENT USED: Prechill of 7 to 10 days helpful; inoculate with rhizobium or native soil.

METHOD OF GROWING: Seed production field.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Direct seeding of grass/forb seed mixture not recommended for use in areas that you do not want to attract grizzly bears--they commonly forage for roots of this plant.

CENTER NAME: Bridger, MT Plant Materials Center

Hedysarum sulfurescens Rydb.

Y E L L O W S W E E T V E T C H

BRIEF DESCRIPTION OF NATIVE HABITAT: Exposed hillsides or understory of open ponderosa pine savannas.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 7/25 - 8/10

NUMBER OF SEEDS PER POUND: 72,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Easily hand stripped but timing is very critical.

METHOD OF CLEANING: Thresh with hammermill--smaller seed may not readily thresh out of loment pod (may be left in loments).

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Hard legume seed may be stored for up to 10 years.

PROPAGATION METHOD: Seeding

PRETREATMENT USED: Prechill of 7 to 10 days helpful; inoculate with rhizobium or native soil.

METHOD OF GROWING: Seed production field.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Direct seeding of grass/forb seed mixture not recommended for use in areas that you do not want to attract grizzly bears--they commonly forage for roots of this plant.

CENTER NAME: Bridger, MT Plant Materials Center

Helianthella uniflora (Nutt.) Torr. & Gray

ONE-FLOWER HELIANTHELLA

BRIEF DESCRIPTION OF NATIVE HABITAT: Open, exposed rangeland and parks, usually with a somewhat southern exposure.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/10 - 8/20

NUMBER OF SEEDS PER POUND: 54,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Large coneheads easily hand stripped; tall stature makes it easy to collect.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Good viability for at least 5 years.

PROPAGATION METHOD: Direct seeding

PRETREATMENT USED: None

METHOD OF GROWING: Establish in seed production rows.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Direct seeding in grass/forb mixtures.

CENTER NAME: Bridger, MT Plant Materials Center

Heterotheca villosa (Pursh) Shinners
Chrysopsis villosa (Pursh) Nutt. ex DC.)

HAIRY GOLDEN ASTER

BRIEF DESCRIPTION OF NATIVE HABITAT: Open dry areas, usually on coarse soils; on obsidian sands may be found in nearly pure stands.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/25 - 9/5

NUMBER OF SEEDS PER POUND: 800,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Erratic seed set and insect predation make this species relatively difficult to collect large quantities.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Good viability for up to 5 years

PROPAGATION METHOD: Grown in cone-tainers, seed production fields.

PRETREATMENT USED: None

METHOD OF GROWING: Establish in seed production fields.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Low stature makes it difficult to harvest. Has been harvested with REM in plot harvester, flail-vac, vacuum cleaner, and hand stripping. Timing of harvest is very critical as the seed shatters only a few days after it is ready.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Transplant containerized plants; include in grass/forb seed mixtures, broadcast seed, and rake.

CENTER NAME: Bridger, MT Plant Materials Center

Heterotheca villosa (Pursh) Shinners
(*Chrysopsis villosa* (Pursh) Nutt. ex DC.)

HAIRY GOLDEN ASTER

BRIEF DESCRIPTION OF NATIVE HABITAT: From Saskatchewan to British Columbia, south to California and Texas. Dry ground; 4,000-10,000 ft. elevation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Indeterminate seeds (August through October)

NUMBER OF SEEDS PER POUND: circa 540,000

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed

PRETREATMENT USED: None

METHOD OF GROWING: Direct plant seed. Collect transplants.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Preferable to use flail-vac and harvest over time.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Debearder required for seed.

RE-ESTABLISHMENT TECHNIQUES: Direct plant or use transplants.

CENTER NAME: Meeker Plant Materials Center

Heuchera cylindrica Dougl. ex Hook.

ROUNDHEAD ALUMROOT

BRIEF DESCRIPTION OF NATIVE HABITAT: Common on coarse soils, often disturbed sites.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 7/20 - 8/1

NUMBER OF SEEDS PER POUND: 7,000,000-8,000,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Plants are scattered, but heads easy to strip.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Seed viable for up to 5 years.

PROPAGATION METHOD: PMC has cleaned only.

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Direct seeding in grass/forb mixture.

CENTER NAME: Bridger, MT Plant Materials Center

Hilaria jamesii (Torr.) Benth.

G A L L E T A

BRIEF DESCRIPTION OF NATIVE HABITAT: "Thrives on silty and clayey soils in southwestern Great Plains and on certain sites dominated by shadscale saltbush in the southern Great Basin region; common and nearly as thrifty on certain well-drained sandy soils and fractured rockland sites in the Colorado Plateau region ...Occurs from about 4,000 ft. to over 8,000 ft. in elevation, and from the southern Great Basin and central New Mexico and Arizona north into SW Wyoming" (undetermined source).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, vegetative

SEED MATURITY DATE: June (first crop); August - October (second crop)

NUMBER OF SEEDS PER POUND: 170,000

PERCENT GERMINATION: 80%-98%

EASE OF COLLECTION: Data not available at date of publication.

METHOD OF CLEANING: Scalping or running through hammermill before fanning in mill.

STORAGE REQUIREMENTS: Undetermined

ESTIMATED PROPAGULE STORAGE POTENTIAL: Undetermined

PROPAGATION METHOD: Seeding; expansion by rhizome

PRETREATMENT USED: None

METHOD OF GROWING: "Drill seed, in special drill equipped to handle chaffy seed, at 1/2 inch depth on fine-textured soils and more moist seedbeds and up to 1 inch deep on coarser soils and drier seedbeds. May broadcast seed but cover with soil to similar depths...Supplemental mulching and light irrigations most reliable method...Plant before or early during the 2-month period with most favorable conditions ...often June 15 to July 15 in northern Arizona and New Mexico" (ibid.).

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: "Plant 20-30 PLS per square foot for range-land stands or 40-60 PLS per linear foot of row for disturbed land stabilization" (ibid.).

CENTER NAME: Los Lunas Plant Materials Center

REFERENCE: Undetermined source

Holodiscus dumosus (Nutt. ex Hook.) Heller
var. *glabrescens* (Greenm.) C.L. Hitchc.

OCEANSPRAY

BRIEF DESCRIPTION OF NATIVE HABITAT: Central and eastern Oregon to northeast Calif. and northwest Nevada; dry, rocky valleys and hillsides to mountains (Hitchcock et al. 1969). At Crater Lake, on rocky, gravelly ridges and hillsides around east rim.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings, seed

SEED MATURITY DATE: End of August, early September

NUMBER OF SEEDS PER POUND: 5,000,000 or more

PERCENT GERMINATION: None achieved after 16 weeks stratification; longer stratification treatments will be completed in June 1993 at Corvallis PMC. Other *Holodiscus* species known to require 20 weeks or longer to stratify, with low germination percentages.

EASE OF COLLECTION: Seed not plentiful but easily collected; fairly slow because of small size.

METHOD OF CLEANING: Well-dried seed hand rubbed and sieved.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Cuttings were treated and placed in vermiculite in a mist bed (with 60% shade) for several weeks (length of time dependent upon species). No cuttings survived. Seed collected in 1992 stratified 12 to 20 weeks.

PRETREATMENT USED: Varied: 1) 1-year-old or current season's growth + 0.8% IBA powder dip; 2) 1-year-old or current season's growth w/o IBA; 3) Older growth + 0.8% IBA powder dip; 4) Older growth w/o IBA.

METHOD OF GROWING: Stratify seed in flats with peat/sand mix; germinate directly in flats and transplant to cone-tainers or one-gallon pots when seedlings are well established.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Small seed is difficult to handle and prepare; easily blown away.

RE-ESTABLISHMENT TECHNIQUES: Fall transplanting planned for container-grown plants for Crater Lake revegetation projects.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Hudsonia tomentosa Nutt.

B E A C H H E A T H E R

BRIEF DESCRIPTION OF NATIVE HABITAT: Low bushy shrub found on eastern coastal sands and sandy sites of the Great Lakes region.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: August - September (when ripe seeds are quick to shatter with increasing winds)

NUMBER OF SEED PER POUND: 900,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Seed is easily collected on coastal dunes of the Mid-Atlantic states. However, seeds are difficult to strip from plants; shattered seed collects in small wind pockets (eddies) around the plants; this shattered material is easy to collect and has good viability.

METHOD OF CLEANING: Lightly run through hammermill, then mechanically screen; gravity separation could be used to remove similar sized sand particles if needed.

STORAGE REQUIREMENTS: After cleaning, seeds are placed in a dehumidified room at <40°F in good

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed propagation in greenhouse, in 1:2 peat-sand mix at rate of 20 g. per square foot; transplant into cone container. Weed control is by hand; irrigation schedule is 1/2-inch biweekly.

PRETREATMENT USED: Various stratification periods are being considered; so far, 60 days of cold wet stratification seems best.

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: A shovel is useful and efficient for collection.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Cape May Plant Materials Center

Hydrangea quercifolia Bartr.

OAKLEAF HYDRANGEA

BRIEF DESCRIPTION OF NATIVE HABITAT: Oakleaf hydrangea occurs as an understory shrub in hardwood stands. It is found most often on sites with a good layer of hardwood leaf litter, growing along the slopes of draws and on well-drained sites near the tops of streambanks.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, root suckers, and softwood cuttings.

SEED MATURITY DATE: October

NUMBER OF SEED PER POUND: 500,000-750,000 (estimate)

PERCENT GERMINATION: More than 50%

EASE OF COLLECTION: Seeds are easy to collect if sufficient seed-bearing plants can be found (sometimes scarce under heavy overstory). Good root suckers require a considerable amount of labor to locate, dig, and pot. Good quality cuttings are not easy to find.

METHOD OF CLEANING: Seed capsules are crushed, and the seed can then be cleaned with an air-screen cleaner.

STORAGE REQUIREMENTS: Unknown; one lot stored in cool, dry conditions has retained good germination after 1 year of storage.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Probably 2 to 3 years

PROPAGATION METHOD: Propagation has been attempted using seed, root suckers, and cuttings.

PRETREATMENT USED: None required (Dirr and Heuser 1987).

METHOD OF GROWING: Seed has been spring-sowed in a peat/vermiculite mix in a greenhouse. Germination was good, but most of the very small seedlings died from unknown causes. A part of the problem of seedling mortality seems to be associated with the foliage becoming wet when watering and being in contact with the growing medium. Fungus or other disease may develop. Good cuttings are not easily located, and as reported by Dirr and Heuser (1987), are difficult to root. More than half of the root suckers which have been potted in a good container-growing medium have failed to survive one year.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: James L. Whitten Plant Materials Center

REFERENCES: Dirr and Heuser 1987.

Ilex decidua Walt.

DECIDUOUS HOLLY

BRIEF DESCRIPTION OF NATIVE HABITAT: Alluvial flood plains, bottomland hardwoods, low woodlands, and wet thickets.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Flowers: April-May. Fruits: Sept.-October.

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Readily accessible

METHOD OF CLEANING: Hand-rubbing, maceration

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seeding and transplanted

PRETREATMENT USED: None

METHOD OF GROWING: Container

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Container-grown and transplanting

CENTER NAME: None - PMS office Baton Rouge, LA

Ipomopsis aggregata (Pursh) V. Grant) var. *aggregata*
(*Gilia aggregata* (Pursh) Spreng.)

SCARLET GILIA

SKYROCKET

BRIEF DESCRIPTION OF NATIVE HABITAT: Open or lightly wooded, rocky slopes, drier meadows, low to high elevations; B.C. to Montana, south to Calif; east side of Cascades. In Crater Lake on dry, sunny meadows and hillsides with well-drained soil.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed. Note: Hitchcock et al. (1969) note that each locule contains "several ovules, but sometimes only one develops to a mature seed."

SEED MATURITY DATE: September

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: < 5%

EASE OF COLLECTION: Slow: Few seeds produced per plant; plants are slightly resinous, causing seed to stick to leaves and stems; stands are thinly scattered and mixed with other forbs, grasses.

METHOD OF CLEANING: Hammermilled with 1/8" screen; hand screened.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: From seed: Few plants produced by direct seeding. Stratification did not improve germination.

PRETREATMENT USED: 56 days cold-moist stratification, preceded by bleach rinse. Exhibited little or no germination.

METHOD OF GROWING: Direct seeded into cone-tainers in greenhouse; four seedlings established and held over winter in lathhouse at Corvallis; regrowth noted in spring of 1993.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Sticky plants (noted above)

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted

RE-ESTABLISHMENT TECHNIQUES: Not planned for revegetation work at Crater Lake: low seed availability and low germination cited as reasons to drop this species from revised agreement (as of 1993).

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Juncus parryi Engelm.

BRIEF DESCRIPTION OF NATIVE HABITAT: Dry granitic slopes; 6,500-12,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, plant divisions

SEED MATURITY DATE: Quantitative values for date of maturity could not be found.

NUMBER OF SEEDS PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: (1990) Hand-screened with size 1/12 screen. Ran through small clipper using screens: 1/16 X 1/4 top and 1/22 bottom, air closed. Cleaned over and over to remove inert. Difficult to remove stems from seed.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Division propagation begun in January. Divided in two, plants were then placed into cold frame for 7 days and then moved into lathhouse. Care must be taken to plant exactly at the crown; *Juncus parryi* had 65% mortality caused by planting too deep.

PRETREATMENT USED: Divisions were placed into Vitamin B-1 solution for 15 minutes to help prevent transplant shock. Seed: none.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Juniperus osteosperma (Torr.) Little

UTAH JUNIPER

BRIEF DESCRIPTION OF NATIVE HABITAT: Often in pure stands at altitudes of 3,000-8,000 ft. on arid slopes or in valleys. In New Mexico, Arizona, Colorado, Utah, Nevada, Idaho, Wyoming, and California.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings, seed

SEED MATURITY DATE: September; dispersal persists 2 years (Young and Young 1992, 190).

NUMBER OF SEEDS PER POUND: Approximately 4,994 (ibid.)

PERCENT GERMINATION: Undetermined. "Seeds...are consistently highly dormant. Prechilling for 14 weeks was required for substantial germination (Young et al. 1988" (ibid.).

EASE OF COLLECTION: Cuttings: It is important to use juvenile growth but is very difficult to get juvenile growth from native stands, and it would take years to establish stock plants large enough to use for cuttings. Seeds: may be stripped or picked by hand (and from the ground).

METHOD OF CLEANING: Maceration (with detergent added to water) and flotation.

STORAGE REQUIREMENTS: Seeds "should be dried to 10%-12% moisture and stored in sealed containers at cold temperatures" (ibid.). Can also be stored as berries.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Undetermined

PROPAGATION METHOD: "Seeds...should be sown in fall to take advantage of natural prechilling...Juniper seeds are usually drilled in well-prepared seedbeds in rows 15-20 cm apart and covered with 0.6 cm of soil" (ibid., 192).

PRETREATMENT USED: Prechilling--cold stratification for 14 to 20 weeks--is recommended.

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Los Lunas Plant Materials Center

REFERENCE: Young and Young 1992

Juniperus osteosperma (Torr.) Little

UTAH JUNIPER

BRIEF DESCRIPTION OF NATIVE HABITAT: Southern Idaho and southwest Wyoming south to eastern and southeastern California, central Arizona, and western New Mexico. Lower hills and foot slopes; gravel, limy soils; 4,000-7,000 ft. elevation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September of the second year.

NUMBER OF SEEDS PER POUND: 4,950

PERCENT GERMINATION: 8%-49%

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Store dry in sealed containers at 20°-40°F. Maintain moisture conditions of 10%-12% for long-term storage.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Over 4 years

PROPAGATION METHOD: Seed

PRETREATMENT USED: Stratify 60 days, 34°F.

METHOD OF GROWING: Direct plant. Maintain in field for at least two years. Lift and store bare root.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Plant as rooted material.

CENTER NAME: Meeker Plant Materials Center

EASTERN RED CEDAR

BRIEF DESCRIPTION OF NATIVE HABITAT: This small dioecious tree has a deep root system, which allows it to survive the poorest and driest sites throughout most of the U.S. south and east of the Dakotas.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: October - December. Subglobose cones, which are pale green turning dark blue at maturity, ripen in the first year.

NUMBER OF SEED PER POUND: 43,600

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Seed is easy to collect throughout much of the eastern coastal plain.

METHOD OF CLEANING: Prior to storage, cones should be sun dried for one week, run through hammermill, then screened mechanically.

STORAGE REQUIREMENTS: 20°-40°F @ 10%-12% moisture content.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Fall seeding into raised beds of sandy loam, at rate of 3.3 g./sq. ft. Transplants are bare-root. Weed control is by hand; irrigation schedule is 1 inch biweekly.

PRETREATMENT USED: 30 to 120 days of cold stratification @ 41°F for spring planting.

METHOD OF GROWING: Unique technique: Seed raised beds with uncleared fruit immediately (1 to 2 days) after harvest.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Cape May Plant Materials Center

MOUNTAIN LAUREL

BRIEF DESCRIPTION OF NATIVE HABITAT: Southern Maine to Ohio, south to Georgia and east Louisiana. Found on acid soils in a wide range of habitats.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed capsules

SEED MATURITY DATE: September - October

NUMBER OF SEEDS PER POUND: Approximately 26,786,000

PERCENT GERMINATION: >70%

EASE OF COLLECTION: Capsules must be collected by hand.

METHOD OF CLEANING: Allow seed capsules to dry, then shake out seed. Minimal screening is sometimes helpful but seed is very tiny.

STORAGE REQUIREMENTS: 40°F, 35% RH in sealed containers

ESTIMATED PROPAGULE STORAGE POTENTIAL: 1 to 3 years

PROPAGATION METHOD: Seed

PRETREATMENT USED: None; seed does not exhibit dormancy.

METHOD OF GROWING: Spring 1992: sown on peat; germination data unavailable, no plants were produced. Winter 1992/Spring 1993: Seed sown on top of screened peat-sand mix (2:1) and placed under continuous light and intermittent mist germinates readily. Keep plants under long days to induce continued growth after germination.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: National Plant Materials Center

REFERENCE: Young and Young 1992, 192-93

Krascheninnikovia lanata (Pursh) Guldenstaedt
(*Ceratoides lanata* (Pursh) J.T. Howell)

WINTERFAT

LAMBSTAIL

WHITE SAGE

BRIEF DESCRIPTION OF NATIVE HABITAT: Stony hillsides, dry soils of plains, lower foothills, and valleys that are moderately impregnated with alkaline or saline material. This species is usually intermixed with various saltbushes, bunchgrasses, rabbitbrush, and greasewood.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed (utricle)

SEED MATURITY DATE: Fall

NUMBER OF SEEDS PER POUND: Seeds per pound will vary by ecotype but average 125,000 with bracts intact. Hammermilled seed with bracts removed averages 200,000 seeds per pound.

PERCENT GERMINATION: Germination is variable, ranging from 17%-100%; with good seed quality it will average 85%-90%. No benefit to germination found with potassium nitrate.

EASE OF COLLECTION: Easily hand stripped from plant inflorescences.

METHOD OF CLEANING: Standard methods including the use of rub board, desktop office cleaner, and South Dakota seed blower. Fruit is a one-seeded utricle with 2 bracteoles that become 4-6 mm long, each with a hornlike tip. The bracteoles are densely hirsute. The fruit is oval, flat, 1.8-2.2 mm long, and covered with white pubescence. The presence of these pubescent trichomes creates the most difficulty in the cleaning process.

STORAGE REQUIREMENTS: Utricle, with bracteoles, stored at 4°C in sealed containers for up to 8 years. Fruit stored 3 years at 10% moisture in sealed containers at 5°-20°C. Storage at room temperature decreases viability (Springfield 1974).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Stored for years under the correct environmental conditions.

Krascheninnikovia lanta (*Ceratoides lanata*)

WINTERFAT (cont.)

PROPAGATION METHOD: Seed. Optimum germination is expressed by alternating temperature regimes. Germination requires no pretreatment. Germinates at 15°C, 13°C, 16°-25°C, or 15°-25°C, first count 3 to 7 days, last count 7 to 14 days. Temperatures below 7°C slow germination. Seedling vigor related to seed source and age. Tetrazolium test: Remove bracts, lay seed on moist blotters overnight, puncture seed, soak 4 hours in 0.1% tetrazolium solution at room temperature (Moyer and Lang 1976; Springfield 1972, 1973; Weber and Wiesner 1980).

PRETREATMENT USED: Freshly harvested seed may require prechilling of 5°C for 14 days prior to germination.

METHOD OF GROWING: Seeded at less than 1/4-inch, 15-20 PLS per square foot.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Collection of seed is best accomplished by hand removal although combine harvesting has been successful.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Pubescence makes seed processing difficult and time consuming. Mechanical damage caused by seed processing and bract removal can result in loss of geotropic response by seedlings (Booth 1984).

RE-ESTABLISHMENT TECHNIQUES: Data unavailable at date of publication.

CENTER NAME: Manhattan Plant Materials Center

REFERENCES: Allen et al. 1987; Booth 1984, 1990, 1992; Dettori et al., 1984; Moyer and Lang 1976; Springfield 1968, 1972, 1973, 1974; Stubbendieck et al. 1982; U.S. Dept. of Agriculture 1937, 1985; Van Dersal 1938; Weber and Wiesner 1980.

Ledum glandulosum Nutt.

W E S T E R N L A B R A D O R T E A

BRIEF DESCRIPTION OF NATIVE HABITAT: Boggy areas; < 11,500 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, cuttings

SEED MATURITY DATE: Quantitative values for date of maturity could not be found.

NUMBER OF SEEDS PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Hand-screened only, three times.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: We did place in storage.

PROPAGATION METHOD: Cuttings received in flats were placed on bottom heat at 70°F soil temperature; misting set for 4 seconds at 6-minute intervals, which was changed to 4 seconds at 10-minute intervals. Soil mix is UCS mix of perlite, peat, vermiculite, sand, and Osmocote (50-50 peat moss/vermiculite mix had poor drainage). Cuttings received in cone cells were placed in lathhouse and fertilized with Osmocote. The latter had the best performance. The results of cuttings were poor.

PRETREATMENT USED: None

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Lespedeza hirta (L.) Hornem.

HAIRY LEAF CLOVER

BRIEF DESCRIPTION OF NATIVE HABITAT: It is abundant in dry soils from Maine to Michigan and Missouri, south to Florida, and Texas. In the GSMNP plants are found on dry, rocky soils near trails, clearings and thickets.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEED PER POUND: Data not available at date of publication.

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Seed can be easily stripped from plants. Most plants have an erect growth habit. Plants, however, are scattered in the park, making collection of seed slow.

METHOD OF CLEANING: Hand screens, aspirator

STORAGE REQUIREMENTS: Unknown. Seed was stored in cold storage (relative humidity <50% temp <50°F).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Two methods have been attempted: 1) Seedlings have been produced in the greenhouse and transplanted to the field. 2) Seed sown directly to field using belt seeder.

PRETREATMENT USED: Mechanical scarification, Forsberg scarifier approximately 15 seconds, *Lespedeza* inoculum.

METHOD OF GROWING: The plants have become established in the field at the PMC by direct seeding and by transplanting seedlings germinated in the greenhouse. Seeds were mechanically scarified, treated with *Lespedeza* inoculum, and planted in January and February to plug trays in the greenhouse in 1991. Seedlings were transplanted to 42-inch spaced rows in the field in April. Spacing between plants was 1 foot. Plants had a very erect, tall growth habit in 1991. As a result, plants had to be staked and mulched to keep them upright.

Lespedeza hirta

HAIRY LEAF CLOVER (cont.)

Seed was harvested in November of 1991. In 1992, the field was increased by seeding mechanically scarified seed with a belt seeder to 42-inch spaced rows. Seed was planted approximately 1-2 inches apart. Germination appeared to be greater than 50% in the field. Stand in the field planted in 1991 from seedlings declined greatly in 1992. No disease organism could be detected by University of Kentucky Plant Pathology diagnostic tests. Stand decline appears related to excessive precipitation during the summer, heavy soils, and poor drainage of the field. Rows seeded to the field in 1992 did not die as readily, but were slow to grow. Planting of an additional increase field is anticipated for spring of 1993. The site is drier and more well drained. Fertility requirements are unknown for this species. Studies of boron requirements are also planned for 1993.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Seed needs to be dehulled for best results. Seed from increase field was hand clipped, run over scalper, and dehulled with rubber roll huller. Seed was cleaned using Clipper fanning mill.

RE-ESTABLISHMENT TECHNIQUES: Seeding will probably be successful if sight is well drained and fairly dry.

CENTER NAME: Quicksand Plant Materials Center

Liatris punctata Hook.

D O T T E D G A Y F E A T H E R

BRIEF DESCRIPTION OF NATIVE HABITAT: Found growing on the drier plains and hills of Manitoba and Saskatchewan, south to Texas and Arizona. It is drought resistant and well adapted to a variety of upland prairie sites. Dotted gayfeather is common on shallow soils or on heavier loam soils.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed (achene) or bulb-like caudex.

SEED MATURITY DATE: Fall

NUMBER OF SEEDS PER POUND: There are approximately 139,000 seeds per pound with this *Liatris* species.

PERCENT GERMINATION: Varies with seed quality.

EASE OF COLLECTION: Hand collected or mechanically harvested with combine. It often grows taller under fertile conditions, and stems supporting inflorescences may tend to lodge and make mechanized harvesting difficult.

METHOD OF CLEANING: Initially utilized hammermill with 3/16 screen at 500 RPM's to remove achenes from inflorescence. Desktop, two-screen cleaner with top screen 12 x 1/2 and bottom screen 1/25 utilized to remove inert material from achenes. Material hand rubbed using rub board between operations of the desk top cleaner.

STORAGE REQUIREMENTS: Another *Liatris* sp. has retained viability for 12 years under controlled temperature and humidity conditions at the Manhattan Plant Materials Center. This may or may not apply to dotted gayfeather.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed. Germination of dotted gayfeather requires no pretreatment. Highest germination percentages of dotted gayfeather were exhibited when an alternating temperature regimen of 35°/20°C was utilized. The plants can be successfully transplanted in early spring while in a dormant condition.

Liatris punctata

D O T T E D G A Y F E A T H E R (cont.)

PRETREATMENT USED: None

METHOD OF GROWING: Standard methods employed.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None known

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Standard methods employed.

RE-ESTABLISHMENT TECHNIQUES: Data unavailable at date of publication.

CENTER NAME: Manhattan Plant Materials Center

REFERENCES: Barr 1983; Great Plains Flora Association 1986; Johnson and Nichols 1970; Kindscher 1992; Nebraska Dept. of Agriculture 1979; Phillips Petroleum Company 1955; Salac 1977; Stubbendieck et al. 1982.

Lindera benzoin (L.) Blume

S P I C E B U S H

BRIEF DESCRIPTION OF NATIVE HABITAT: A common deciduous understory shrub found in the eastern U.S., which grows best on moist peaty or sandy sites with pH of 4.5-6.0.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September - October. The 1/2-inch X 1/4-inch green fruit turns bright red at maturity.

NUMBER OF SEED PER POUND: 4,500

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Seed was easily found and collected on upland cove hardwood sites in northern New Jersey. However, ripe fruit is sought after by birds.

METHOD OF CLEANING: Macerate with water, then float off pulp and empty seed; follow with sun drying.

STORAGE REQUIREMENTS: Seed lose viability soon after maturity, but can be prolonged with low temperature storage.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Fall seeding into raised beds of sandy loam at rate of 2.1 g./sq. ft. Transplants are bare-root. Weed control is by hand; irrigation schedule is 1 inch biweekly.

PRETREATMENT USED: 120 days of stratification @ 41°F.

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Within one week of leaf drop, birds can claim all fruit, thus it is best to time collection prior to leaf fall.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Cape May Plant Materials Center

S P I C E B U S H

BRIEF DESCRIPTION OF NATIVE HABITAT: Maine to Kansas, south to Florida and Texas. Understory shrub best adapted to moist, well-drained soils.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Fruit

SEED MATURITY DATE: September - October

NUMBER OF SEEDS PER POUND: Approximately 4,540

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Collected by hand

METHOD OF CLEANING: Fruit has been pulped in water to obtain clean seed, or has been dried (fruit dries on the seed). First method is recommended.

STORAGE REQUIREMENTS: 40°F, 35% RH in sealed containers

ESTIMATED PROPAGULE STORAGE POTENTIAL: 1 to 2 years max.

PROPAGATION METHOD: Seed

PRETREATMENT USED:

1992: 3 weeks warm, moist stratification followed by 86 days cold, moist stratification.

1993: 1 month warm stratification, followed by 3 months cold stratification.

METHOD OF GROWING: Sow in pots in the greenhouse. All plantings failed in 1992.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: National Plant Materials Center

REFERENCE: Young and Young 1992, 206

Lonicera involucrata Banks ex Spreng.

BUSH HONEYSUCKLE

TWINBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Woodlands, thickets, sea level to high elevations, moist to wet soil; Alaska to Mexico, east to Montana and New Mexico, occasionally Mich. and Quebec (Hitchcock et al. 1969). In Crater Lake, near creeks, streams, seepy soils near waterfall area.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings, seed

SEED MATURITY DATE: Late August - early September

NUMBER OF SEEDS PER POUND: Approximately 327,000 (Young & Young 1992)

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Moderate amounts of cuttings can be collected unobtrusively from established stands. Berries available in moderate amounts in 1991, very limited amounts in 1992.

METHOD OF CLEANING: Berries depulped in blender with added water; strained seed and pulp dried on paper toweling, hand rubbed and screened to remove dried pulp.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Not known; honeysuckle seed usually dormant, requiring stratification. Should remain viable in dry storage for some time.

PROPAGATION METHOD: Cuttings very successful. One-year growth (current season) collected as summer-active cuttings rooted well in mist bench with no hormone treatment. Older wood also rooted well; IBA appeared to be slightly detrimental to root development. Seed: Not tried at PMC; long stratification or fall sowing outdoors recommended (Young & Young 1986).

PRETREATMENT USED: None noted.

METHOD OF GROWING: Well-rooted plants transplanted to one-gallon containers containing peat/perlite/organic compost-based potting soil mix. Held over winter in lathhouse.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Fall transplanting at Crater Lake National Park is planned for revegetation projects.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969; Young & Young 1986, 1992

Lonicera utahensis S. Wats.

UTAH HONEYSUCKLE

BRIEF DESCRIPTION OF NATIVE HABITAT: In Glacier National Park, found as a landscape plant near Swift Current Motor Inn.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Fruit

SEED MATURITY DATE: 7/25 - 8/10

NUMBER OF SEEDS PER POUND: 113,500

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Data not available.

METHOD OF CLEANING: Thresh with Dybvig seed cleaner and set out to dry.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: If stored in a sealed container at cool temperatures (38°-40°F), will stay viable for over 10 years.

PROPAGATION METHOD: Dormant fall plant or spring plant with 60 to 90 days prechill treatment.

PRETREATMENT USED: See above.

METHOD OF GROWING: Establish in propagation beds; grow either containerized or bare-root material.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Transplants.

CENTER NAME: Bridger, MT Plant Materials Center

Lupinus argenteus Pursh
ARGENTA LUPINE,
SILVER LUPINE

BRIEF DESCRIPTION OF NATIVE HABITAT: Found from the foothills through the subalpine zone from Montana to New Mexico and Arizona. Occurs at the edge of the woods or in open places.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: July to August

NUMBER OF SEEDS PER POUND: 1,275 to 3,439

PERCENT GERMINATION: 50%-80% (estimated)

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: Long periods of time when dried. However, a hard seedcoat develops with prolonged storage.

PROPAGATION METHOD: Seed

PRETREATMENT USED: Stored seeds can be treated with boiling water and soaked for 12 to 24 hours before sowing. Fresh seed can be sown without treatment.

METHOD OF GROWING: Direct plant seed in late fall. Use inoculant at the time of seeding. Irrigate only under extreme drought. Do not allow livestock to graze on the planted area because many species of lupine are considered toxic.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Information unavailable

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Direct seeded in late fall.

CENTER NAME: Meeker Plant Materials Center

Lupinus covillei Greene

BRIEF DESCRIPTION OF NATIVE HABITAT: Depressions, meadow edges, moist rocky slopes, 8,000-11,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Quantitative values for date of maturity could not be found.

NUMBER OF SEEDS PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Hand-screening using #11 screen; small clipper: 2 times, screens #10 & #6, air 50% open.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed germinated in greenhouse and moved to lath-house.

PRETREATMENT USED: Seed: no treatment required for fresh seed; scarification or hot water for stored seed.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Lupinus elmeri Green
(*Leupinus lepidus* Dougl. ex Lindl. var. *lobbii* (Gray ex S. Wats.) Jepson)

D W A R F L U P I N E

BRIEF DESCRIPTION OF NATIVE HABITAT: Dry spine summits, 6,500-11,500 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Quantitative values for date of maturity could not be found.

NUMBER OF SEEDS PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Hammermill: screen #12, 750 rpm. Small clipper: screen # 6 & 1/15". Last cleaning: screen #1/12 & 1/15, 20% air.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed germinated in greenhouse and moved to lath-house.

PRETREATMENT USED: No treatment required for fresh seed; scarification or hot water for stored seed.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Lupinus havardii S. Wats.

CHISOS BLUEBONNET

BRIEF DESCRIPTION OF NATIVE HABITAT: Gravelly, fine talus or alluvial soils in deserts or valleys and on hills and mountain slopes.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: May-June

NUMBER OF SEED PER POUND: 3,000

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Relatively easy

METHOD OF CLEANING: Hammermill and shaker, air-screen separation

STORAGE REQUIREMENTS: Standard procedure

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed

PRETREATMENT USED: Rhizobia inoculation

METHOD OF GROWING: Direct seeding on normally prepared listed beds; irrigation, fertilization, cultivation.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Standard range-seeding methodology recommended for the Trans-Pecos region of Texas. PROBLEMS: First year, stand wiped out by marauding birds; second year, good stand began to deteriorate, possibly due to severe cold weather.

CENTER NAME: Knox City Plant Materials Center

REFERENCES: Ajilvsgi 1991, 335.

Lupinus latifolius Lindl. ex J.G. Agardh

BROADLEAF LUPINE

BRIEF DESCRIPTION OF NATIVE HABITAT: Cascade Mts., B.C. to Calif., west to coast; subalpine to lowland (Hitchcock et al. 1969). Widely distributed at Mt. Rainier and Crater Lake national parks.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Extremely variable: higher elevation ecotypes, July to Sept. in native habitat; same ecotype produces seed in June at Corvallis PMC.

NUMBER OF SEEDS PER POUND: 350,000

PERCENT GERMINATION: Variable: has ranged from 18% germ. plus 3% hard seed to 27% germ. with 42% hard seed.

EASE OF COLLECTION: Easy, relatively fast if good seed production year.

METHOD OF CLEANING: Dry pods in loose cloth bags or covered tarps; 1/4" screen hammermill (or thresher for large volumes), air screen with #10 round screen, high air flow.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Several years, due to hard seed

PROPAGATION METHOD: Direct seed, or transplant plugs to field; plant pre-soaked seed in cone-tainers with lupine inoculum.

PRETREATMENT USED: Seeds soaked 1 to 16 hours in hot to warm water (longer times/lower temperatures). Inoculate at planting time with *Rhizobium lupini*.

METHOD OF GROWING: Plots were harrowed and roto-tilled to a depth of four inches prior to any treatment application, then seeded perpendicularly to soil treatments at rate of 35 pure live seeds per sq. ft. All plots were irrigated. Soil treatments included incorporation of peat moss and/or slow-release fertilizer (17-6-12), and/or addition of erosion-control netting (after seeding). Establishment was hindered by addition of erosion-control netting. Established for seed increase at PMC by drilling seed in April, or by transplanting greenhouse-grown cone-tainer plants.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Seed pods shatter at maturity, so should be harvested while pods still closed.

NOTE: Seed ripens very unevenly; small plots hand-harvested three times. Fill cloth bags loosely with clipped heads; dry in bags or on tarps covered with cloth or burlap to avoid seed loss when pods pop open. Larger fields may be windrowed and machine harvested.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

Lupinus latifolius

B R O A D L E A F L U P I N E (cont.)

RE-ESTABLISHMENT TECHNIQUES: Revegetation plots at Mt. Rainier and Crater Lake (experimental design): 15 pure live seeds per sq. ft. sown in individual strips within each soil treatment: 1) Control--no treatment except initial ripping, rock removal, and roto-tilling; and 2) BMP (best management practice)--incorporation of 1" peat moss, slow-release fertilizer, plus installation of erosion control blanket (Sierrablen 18-7-10, 9-month release used at rate of approx. 175 lbs. nitrogen per acre; S-150 erosion control blanket used). At each site, ecotypes adapted to elevation were used. Data on emergence, establishment to be reported in SCS annual reports to Park Service.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Lupinus lepidus Dougl. ex Lindl.

PRAIRIE LUPINE

(Five botanical varieties exist; varietal designation of this collection was not determined.)

BRIEF DESCRIPTION OF NATIVE HABITAT: B.C. to Calif., both sides of Cascades, east to Montana, Colorado (Hitchcock et al. 1969). At Crater Lake, in exposed pumice soils, ridges, gravelly areas at higher elevations in park.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: None; small amount of seed collected for possible observational planting at later date.

SEED MATURITY DATE: Data unavailable at date of publication.

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Hand collected; relatively slow to accumulate seed because of diminutive plant size.

METHOD OF CLEANING: Small amount of seed collected here was dried in pods in paper bags, hand threshed, and screened to remove pods and stem material.

STORAGE REQUIREMENTS: Air-dried seed stored in cool, dry conditions.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Expect some seed to remain viable for more than two years due to presence of hard seed.

PROPAGATION METHOD: No propagation conducted at PMC.

PRETREATMENT USED: None tried at PMC; hot water soak may help soften seed coat.

METHOD OF GROWING: None grown at PMC. Cone-tainer production using a fast-draining soil mix could provide room for deep taproot to develop.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Very limited potential for mechanized seed increase because of extremely low-growing stature.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: No trials are planned in Crater Lake agreement; direct seeding or transplanting should be feasible (as for *L. latifolius*).

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Lupinus sericeus Pursh

SILKY LUPINE

BRIEF DESCRIPTION OF NATIVE HABITAT: Open meadow and parks in lodgepole pine/Douglas fir habitat types.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/1 - 8/20

NUMBER OF SEED PER POUND: 19,700-42,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Seed set is indeterminate and erratic, susceptible to insect damage; collection is time-consuming because there are only 2 to 6 seeds per pod.

METHOD OF CLEANING: Dried seed pods run through hammermill and passed through fanning mill.

STORAGE REQUIREMENTS: Cold, dry; may require insecticide because of insect larvae in seed.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Seed storage 5 to 10 years with minimal loss in viability.

PROPAGATION METHOD: Seeding

PRETREATMENT USED: Because of high mortality of 2- to 3-week-old seedlings, it is recommended that seed be inoculated with the appropriate rhizobium (H-culture).

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Bridger, MT Plant Materials Center

Melica spectabilis Scribn.

ONION GRASS

MELIC GRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Montana to British Columbia, south to Colorado and northern California. Rocky or open woods and thickets; loam and clayey soils; 4,500-10,000 ft. elevation; 16-22 in. precipitation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: July to August

NUMBER OF SEEDS PER POUND: 556,000

PERCENT GERMINATION: 74%

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed

PRETREATMENT USED: None

METHOD OF GROWING: Direct seeding

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Direct seeding

CENTER NAME: Meeker Plant Materials Center

SHOWY MENODORA

BRIEF DESCRIPTION OF NATIVE HABITAT: Rocky habitats, mostly mountains and canyons; most commonly on limestone but also igneous soils--Trans-Pecos and Edwards Plateau of Texas, southern New Mexico, south to central Mexico.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: October

NUMBER OF SEED PER POUND: 57,500

PERCENT GERMINATION: 70%

EASE OF COLLECTION: Relatively easy

METHOD OF CLEANING: Hammermill, shaker, air-screen separation

STORAGE REQUIREMENTS: Standard procedure

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed, transplant

PRETREATMENT USED: None

METHOD OF GROWING: Direct seeding; transplanting on normally prepared listed beds; irrigation, fertilization, cultivation.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Standard range-seeding methodology recommended for the Trans-Pecos region of Texas.

CENTER NAME: Knox City Plant Materials Center

REFERENCES: Powell 1988, 331.

Myrica cerifera L.

WAX MYRTLE

BRIEF DESCRIPTION OF NATIVE HABITAT: Dioecious evergreen to semi-evergreen shrub found in sandy swamps and wet woods of the coastal plain from southern New Jersey to Florida and west to Texas.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September - October

NUMBER OF SEED PER POUND: 84,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Abundant seed was easily collected from the forested areas of Assateague Island, MD.

METHOD OF CLEANING: Hand rub to remove waxy coat; follow with mechanically screening, using moderate air.

STORAGE REQUIREMENTS: Maximum stored viability is maintained if waxy coat remains and seed is refrigerated @ <40°F.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Fall seeding into raised beds of sandy loam at rate of 3 g./sq. ft. Hand weed; irrigation is one inch biweekly. Transplants are bare-root.

PRETREATMENT USED: Clean seed.

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Cape May Plant Materials Center

B A Y B E R R Y

BRIEF DESCRIPTION OF NATIVE HABITAT: Dioecious upright shrub is found on dry and wet sandy coastal sites from Nova Scotia to Florida and west to Louisiana, and along the shores of Lake Erie; inland bogs of northern New Jersey and Pennsylvania also have populations of this species growing.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September - October

NUMBER OF SEED PER POUND: 55,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: In September, migrating birds often feed on the ripe fruit as they follow the Atlantic Flyway south. Otherwise, abundant seed is consistently collected with ease from various Mid-Atlantic coastal dune locations annually.

METHOD OF CLEANING: Hand rub to remove waxy coat; follow with mechanically screening using moderate air.

STORAGE REQUIREMENTS: Maximum stored viability is maintained if waxy coat remains and seed is refrigerated @ <40°F.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Fall seeding into raised beds of sandy loam at rate of 3 g./sq. ft. Hand weed; irrigation is one inch biweekly. Transplants are bare-root.

PRETREATMENT USED: Clean seed.

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Cape May Plant Materials Center

SOURWOOD

BRIEF DESCRIPTION OF NATIVE HABITAT: Found in woods and clearings from Florida to Louisiana north to Pennsylvania, West Virginia, Ohio, and Indiana. In the GSMNP, trees were found in wooded areas and clearings on steep slopes and flats.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September - October (Young & Young 1992, 235)

NUMBER OF SEEDS PER POUND: 1,816,000 - 5,448,000 (ibid.)

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Seed is not difficult to collect. As seed is small, many seeds can be collected from one tree. Seed collections were made from October to December at the GSMNP.

METHOD OF CLEANING: Rub board, hand screens

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seedlings propagated in the greenhouse and planted to raised beds in field.

PRETREATMENT USED: None

METHOD OF GROWING: Seed was sown in flats in peat, covered with plastic to maintain humidity, and placed under continuous light. Germination was fair. Seedlings on 1:1:1 peat, perlite, vermiculite in cone-containers and placed under continuous light also germinated successfully. Maintaining moisture and light appears important for germination. Seedlings are very slow to grow in the greenhouse once germinated. A few plants have been successfully transplanted to a raised bed in the field, but growth was minimal. Seed harvested in November of 1992 successfully germinated in the greenhouse by January 1993. Depending on size of seedlings in late spring, plants may be grown in containers for a year before planting to raised beds.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Production of adequate size trees for transplanting will require at least two growing seasons.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: No unique techniques have been determined.

CENTER NAME: Quicksand Plant Materials Center

REFERENCES: Young and Young 1992

Oxytropis splendens Dougl. ex Hook.

SHOWY LOCOWEED

BRIEF DESCRIPTION OF NATIVE HABITAT: Open range sites; dry, well-drained soils.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/1 - 8/10

NUMBER OF SEEDS PER POUND: 704,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Very few, scattered plants, but seedhead capsules retain seed well after maturity.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Hard legume seed will retain viability for 5 to 10 years.

PROPAGATION METHOD: PMC cleaned seed only.

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Direct seed in grass/forb mixtures.

CENTER NAME: Bridger, MT Plant Materials Center

Pectis angustifolia Torr.

LIMONCILLO

BRIEF DESCRIPTION OF NATIVE HABITAT: Dry, sandy, or calcareous soils of open areas, plains, deserts, hills, and slopes in the Panhandle, Edwards Plateau, and Far West regions of Texas.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September-October

NUMBER OF SEED PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Moderate--very low-growing and scattered

METHOD OF CLEANING: Shaker, air-screen separation

STORAGE REQUIREMENTS: Standard procedure

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed and transplants

PRETREATMENT USED: None

METHOD OF GROWING: Direct seeding; transplanting on normally prepared listed beds; irrigation, fertilization, cultivation.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Standard range-seeding methodology recommended for the Trans-Pecos region of Texas; will be used as a filler in the seeding mixture.

CENTER NAME: Knox City Plant Materials Center

REFERENCES: Ajilsvgi 1991, 135.

Penstemon albertinus Greene
ALBERT PENSTEMON

Penstemon confertus Dougl.
YELLOW PENSTEMON

Penstemon lyallii Gray
LYALL PENSTEMON

BRIEF DESCRIPTION OF NATIVE HABITAT: Invader species on coarse soils (road cuts, burns, talus slopes)

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE:

<u>P. albertinus</u> 8/10 - 8/20	<u>P. confertus</u> 8/10 - 8/20	<u>P.lyallii</u> 8/20 8/30
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NUMBER OF SEED PER POUND:

<u>P. albertinus</u> 2,300,000	<u>P. confertus</u> 2,700,000	<u>P.lyallii</u> 1,900,000
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PERCENT GERMINATION: See "Pretreatment" below.

EASE OF COLLECTION: Cup-like seed pods retain seed well after maturation. Speed of collection dependent on stand density.

METHOD OF CLEANING: Dried seedheads run through hammermill and passed through fanning mill.

STORAGE REQUIREMENTS: Cool, dry storage

ESTIMATED PROPAGULE STORAGE POTENTIAL: Seed storage 5 to 10 years with minimal loss in viability.

PROPAGATION METHOD: Seeding

PRETREATMENT USED: Because direct seeding resulted in less than 10% germination, seed was put in ice cube trays. Seed sat in water for 24 hours and then was frozen for 30 days. This treatment resulted in 50%-60% germination and emergence.

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Bridger, MT Plant Materials Center

Penstemon

P E N S T E M O N

BRIEF DESCRIPTION OF NATIVE HABITAT: Like well-drained soils, and thrive on infrequent waterings.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Variable

NUMBER OF SEED PER POUND: Variable

PERCENT GERMINATION: Variable

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Data not available at date of publication.

STORAGE REQUIREMENTS: Data not available at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data not available at date of publication.

PROPAGATION METHOD: Sow in fall, or cold stratification.

PRETREATMENT USED: 4 to 8 weeks cold stratification

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data not available at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data not available at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Los Lunas Plant Materials Center

P E N S T E M O N

(The accession being worked with for the Rocky Mountain National Park will be taxonomically identified by the UCEPC upon flower and seed formation.)

BRIEF DESCRIPTION OF NATIVE HABITAT: Rocky Mountain National Park. The exact site requirements will depend on the species of penstemon that has been collected from the park.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: June to July. Flowers do not usually occur during the first year of growth.

NUMBER OF SEEDS PER POUND: circa 280,000

PERCENT GERMINATION: 50%-65% (estimated from various species)

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: At least five years.

PROPAGATION METHOD: Seed, or by off-shoots obtained by dividing the base of older plants. Use a seeding rate of from 3-5 lb. PLS per acre. The row spacing should be from 30- to 40-inches for ease of cultivation.

PRETREATMENT USED: Stratify 60 days, 34°F.

METHOD OF GROWING: Direct seeding. Minimal irrigation is used to avoid fusarium wilt.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Direct seeding

CENTER NAME: Meeker Plant Materials Center

Pentaphylloides floribunda (Pursh) A. Love
(*Potentilla fruticosa* auct. non L.)

SHRUBBY CINQUEFOIL

BRIEF DESCRIPTION OF NATIVE HABITAT: Throughout North America, Europe and Asia. Valleys and slopes, often in rocky or moist ground; 7,000-11,500 ft. elevation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: July to September

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: 5 years

PROPAGATION METHOD: Seed or late summer wood cuttings

PRETREATMENT USED: Stratify 60 days, 34°F

METHOD OF GROWING: Direct seeded or take late summer wood cuttings and place under mist irrigation. Upon root formation, pot or place in field. Irrigate only under dry conditions.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Late summer cuttings (softwood) have achieved up to 100% root formation and survival.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Direct seeded or establish from rooted transplants.

CENTER NAME: Meeker Plant Materials Center

Persea borbonia (L.) Spreng.

R E D B A Y

BRIEF DESCRIPTION OF NATIVE HABITAT: Distribution is not well known (Brown 1965). Normally found along margins of streams and swamps in southern Louisiana, or as an understory in uplands (USDA 1977).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: None collected to date

SEED MATURITY DATE: Flowers: March-April. Fruits: June-July

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Data unavailable at date of publication.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Data unavailable at date of publication.

PRETREATMENT USED: Data unavailable at date of publication.

METHOD OF GROWING: Data unavailable at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Data unavailable at date of publication.

CENTER NAME: None - PMS office Baton Rouge, LA

REFERENCES: Brown 1965; USDA 1977

Phacelia hastata Dougl. ex Lehm.

SILVERLEAF PHACELIA

BRIEF DESCRIPTION OF NATIVE HABITAT: Coarse soils (sand, granitic, gravels); pioneer species on disturbed sites.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/10 - 8/30

NUMBER OF SEED PER POUND: 153,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Relatively easy (see below).

METHOD OF CLEANING: Dried seedheads run through hammermill and passed through fanning mill.

STORAGE REQUIREMENTS: Cool-dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: 5 to 10 years

PROPAGATION METHOD: Seeding

PRETREATMENT USED: None

METHOD OF GROWING: Although dormant fall seeding is recommended, it has been established with early spring planting.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Because of its lower growth stature, the entire plant is harvested with a flail-type forage harvester.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Bridger, MT Plant Materials Center

Phleum alpinum L.

ALPINE TIMOTHY

BRIEF DESCRIPTION OF NATIVE HABITAT: Streambanks and meadows in northwest mountains; North America, South America, and Europe (Hitchcock et al. 1969). Collected at 5,000 to 6,000 ft. in Mt. Rainier in wet meadows, near lake.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September at Mt. Rainier

NUMBER OF SEEDS PER POUND: Approximately 1,100,000

PERCENT GERMINATION: 98% (with 7-day prechill)

EASE OF COLLECTION: Hand harvested; ripened seed retained for short time on plants.

METHOD OF CLEANING: Hand rubbed or hammermilled to thresh; air-screened with 1/14" round screen, low air flow.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Not determined

PROPAGATION METHOD: Direct seeded in field in April

PRETREATMENT USED: 7-day prechill

METHOD OF GROWING: Drilled with Plant Jr. #10, 2.4 lbs./ac bulk (resulted in fair stand; higher seed rate and/or shallower drilling). Weed control consisted of hand weeding and/or roto-tilling where possible. For grass fields, chemical weed control of broadleaves consisted of one or more applications of 2,4-D + Banvel; control of grasses and broadleaves between rows consisted of wicking Roundup or spot-spraying with Roundup. Irrigation was applied in May, June, and July as necessary. For fields planted in 1991, ammonium nitrate (50 lbs N per acre) and sulfur (15 lbs S per acre) was applied in March and again in May; ammonium nitrate (50 lbs N per acre) was applied in December.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Included in 1992 revegetation plot study installed by PMC at Mt. Rainier National Park. Data on establishment and growth will be collected in 1993 and 1994.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Phlox diffusa Benth.

S P R E A D I N G P H L O X

BRIEF DESCRIPTION OF NATIVE HABITAT: Western states (west of continental divide) to mountains of Wash. and south B.C. down to Sierra Nevadas. At Crater Lake National Park, on dry pumice flats, sandy or gravelly soils, in openings and large clearings.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, small stem cuttings

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Very difficult: seed production was very low in 1991 and 1992 (maybe always?). Single seed per flower, and these were often empty. Difficult to collect stems in any quantity without decimating entire plant.

METHOD OF CLEANING: Small amounts of seed collected did not require cleaning.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Root division or cutting used in nursery trade for other phlox species; experimental seed germination to be conducted at PMC 1993 to 1995.

PRETREATMENT USED: Fresh seed; KNO₃ to be included in germ. trial.

METHOD OF GROWING: Needs well-drained soil mix.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: See "Collection" comments above: collection opportunities are limited by low seed set and small plant size.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Fall transplanting of container-grown stock is planned.

CENTER NAME: Corvallis Plant Materials Center

Phyllodoce breweri (Gray) Heller

RED MOUNTAIN HEATHER

BRIEF DESCRIPTION OF NATIVE HABITAT: Moist rocky slopes, meadows, sub-alpine; 4,000-11,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, cuttings

SEED MATURITY DATE: Quantitative values for date of maturity could not be found.

NUMBER OF SEEDS PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Hand-screened only, three times.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Propagules not stored.

PROPAGATION METHOD: Cuttings received in flats were transplanted into cone cells in UCD mix of perlite, peat, vermiculite, sand, and Osmocote (50-50 peat-vermiculite mix had poor drainage). These were placed on bottom heat at 70°F soil temperature. Misting was set for 4 seconds at 6-minute intervals, later changed to 4 seconds at 10-minute intervals. Cuttings received in cone cells were placed in lathhouse and fertilized with Osmocote. The latter, left in lathhouse for entire winter, had better performance than cuttings rooted in greenhouse. Results with cuttings were poor.

PRETREATMENT USED: Seeds: 2 months cold stratification at 35°; seed mixed with moist vermiculite in a sealed plastic bag.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: It was planted at a seeding rate of 1 pound per acre (30" rows). Seeded on 11-10-90, the two acres were rated as a good initial stand; however, the seedlings were 1-2 inches tall when 10°F temperature occurred at the end of December, 1990; this killed the stand.

CENTER NAME: Lockeford Plant Materials Center

Physocarpus malvaceus (Greene) Kuntze

NINEBARK

BRIEF DESCRIPTION OF NATIVE HABITAT: Usually found as a dense understory shrub under an open forest canopy.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, cuttings

SEED MATURITY DATE: 8/20 - 8/30

NUMBER OF SEEDS PER POUND: 750,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Although stands are usually dense, seed ripening is indeterminate and does not always have good fill.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Seed viability good for at least 5 years.

PROPAGATION METHOD: Seed in containers; root cuttings.

PRETREATMENT USED: Fall plant, spring plant with 30-day prechill.

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Transplants.

CENTER NAME: Bridger, MT Plant Materials Center

Pinus edulis Engelm.

PINYON PINE

BRIEF DESCRIPTION OF NATIVE HABITAT: Semi-arid regions in Utah, Colorado, Arizona, and New Mexico. Valleys, foothills, and lower mountains; gravel, stoney, limy loam soils; 5,500-7,000 ft. elevation; 16-20 in. precipitation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September to October

NUMBER OF SEEDS PER POUND: 1500 to 2500

PERCENT GERMINATION: 80%

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Hand cleaning

STORAGE REQUIREMENTS: Should be dried to a moisture content of from 5%-10%. Can be stored at 33°-41°F, but temperatures from 0°-5°F are better for long-term storage.

ESTIMATED PROPAGULE STORAGE POTENTIAL: 5 to 10 years

PROPAGATION METHOD: Seed, or by bare-root transplant.

PRETREATMENT USED: Stratification: soak in water for 1 to 2 days, then place in moist medium at 33°-45°F for up to 60 days.

METHOD OF GROWING: Direct plant seed or collect bare-root transplants after two years in the field.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Direct plant seed or bare-root transplant.

CENTER NAME: Meeker Plant Materials Center

Pinus flexilis James

LIMBER PINE

WHITE PINE

ROCKY MOUNTAIN WHITE PINE

BRIEF DESCRIPTION OF NATIVE HABITAT: Dry, windswept sites in montane forests; more alpine range in southern latitudes; low humidity; wide temperature fluctuations; cold, dry winters; tolerate Chinook winter winds; limestone and sandstone soils in MT and WY.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Mid-late August through September

NUMBER OF SEED PER POUND: Approximately 500

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Collected from standing trees, on ground, or from animal caches.

METHOD OF CLEANING: Air drying up to 30 days in a sunny location usually sufficient for opening; hand shaking to remove seed.

STORAGE REQUIREMENTS: Same as other *Pinus*: 5%-10% moisture content at 2°-5°C for long-term storage of seed. Storage of cones (short-term) probably best under cool, dry conditions.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Literature indicates good for 5 years (seed).

PROPAGATION METHOD: Direct seeding

PRETREATMENT USED: 48-hour soak in water, 90 days in cooler at 3°-5°C inside moistened peat:sand media treated with a fungicide (usually Captan).

METHOD OF GROWING: Direct seeding into cone-tainers in greenhouse is the only method we've used at Bridger, but field (nursery) production is apparently common.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Bridger, MT Plant Materials Center

Pityopsis graminifolia (Michx.) Nutt.

GRASS-LEAVED GOLDASTER

BRIEF DESCRIPTION OF NATIVE HABITAT: Delaware to Florida, west to Ohio, Texas, and Mexico. Prefers dry soils in sun or partial shade.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: October

NUMBER OF SEED PER POUND: 350,000-400,000

PERCENT GERMINATION: >90%

EASE OF COLLECTION: Difficult--seed matures over 3 to 4 weeks and blows away as soon as mature.

METHOD OF CLEANING: Hairy pappus remains attached to the seed after harvest. For large amounts of seed: run through hammermill 2 times, then run through clipper 2 to 3 times using different size screens. Very difficult to obtain 100% clean seed.

STORAGE REQUIREMENTS: 40°F, 35% RH in cloth seed bags or polyethylene bags.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Unknown, est. 2 to 3 years

PROPAGATION METHOD: Seed

PRETREATMENT USED: None; seed germinates readily. Better germination is obtained if seed is harvested after 1 to 2 hard frosts.

METHOD OF GROWING: Sow in flats in the greenhouse, transplant to plugs, then to fields. Avoid watering small seedlings at times when water will remain on the foliage for a long time. This may cause leaves to rot and plants to die. Field plantings grow best in full sun on well-drained soil with little care.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Attempts were made to vacuum seed using hand-held leaf blower-vacuum: this works well--only mature seed is removed from the plant--but is labor intensive. A tractor-mounted vacuum may be more feasible. Bulk of seed in 1992 production was collected by cutting stems by hand and allowing seedheads to dry on tarps. Seeds were then shaken out of the seed heads and other debris removed when possible. Mature plants have been harvested in late summer when plants were in full leaf and beginning bloom. Harvested plants were potted, placed in the shade, and kept well watered. There was little wilting and no mortality of plants handled in this fashion.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: National Plant Materials Center

Poa fendleriana (Steud.) Vasey

MUTTON GRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Data unavailable at date of publication.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Data unavailable at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Data unavailable at date of publication.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Data unavailable at date of publication.

PRETREATMENT USED: Data unavailable at date of publication.

METHOD OF GROWING Data unavailable at date of publication.:

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Data unavailable at date of publication.

CENTER NAME: Los Lunas Plant Materials Center

Poa fendleriana (Steud.) Vasey

MUTTON GRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Manitoba to British Columbia, south through western South Dakota (Black Hills) and Idaho to western Texas and California; northern Mexico. Mesas, open dry woods, and rocky hills at medium altitudes--foothills and mountain slopes; gravelly and shale soils; 4,500-8,000 ft. elevation; 16-22 in. precipitation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: June to July

NUMBER OF SEEDS PER POUND: circa 925,000

PERCENT GERMINATION: circa 69%

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cold, dry storage

ESTIMATED PROPAGULE STORAGE POTENTIAL: Up to 5 years

PROPAGATION METHOD: Seed

PRETREATMENT USED: None

METHOD OF GROWING: Direct plant seed. Use 2-4 lb. PLS per acre.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Information unavailable

RE-ESTABLISHMENT TECHNIQUES: Direct plant seed.

CENTER NAME: Meeker Plant Materials Center

Poa nervosa (Hook.) Vasey var. *wheeleri* (Vasey) C.L. Hitchc.
(*Poa wheeleri* Vasey)

WHEELER'S BLUEGRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Mountains, open forest in rich soil; 4,000-12,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Quantitative values for date of maturity could not be found.

NUMBER OF SEEDS PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Seed cleaned by hand with screen size #8. Then cleaned on small clipper with screen sizes: top = 1/12; bottom = blank with air closed off. Seed is easy to clean; all inert is much lighter and is blown off.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

PRETREATMENT USED: None required.

METHOD OF GROWING: Was planted in field, one year, for seed; data is poor.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data unavailable at date of publication.

CENTER NAME: Lockeford Plant Materials Center

Polemonium occidentale Greene

JACOB'S LADDER

BRIEF DESCRIPTION OF NATIVE HABITAT: Swamps, stream edges, very wet places at moderate elevations in mountains; cordilleran region Alberta and B.C. to Calif. and Colorado (Hitchcock et al. 1969). At Crater Lake, at base of steep rocky cliffs along seeps; found in same area as large clusters of *Sambucus racemosa*.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Early to mid-September

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: 3%--and these seedlings were quickly overcome by mold during germination.

EASE OF COLLECTION: Fairly easy: plants easily recognized by leaves after flowering completed.

METHOD OF CLEANING: Hammermill with 1/16" screen; air-screened with 1/13" round screen; medium-low air flow.

STORAGE REQUIREMENTS: Cool/dry; or, fresh seed planted directly may result in better germination.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: No seed treatment recommended (Emery 1988).

PRETREATMENT USED: 56 days and 95 days cold-moist stratification. Exhibited little or no germination.

METHOD OF GROWING: Data unavailable at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: No plans for reestablishing; species was dropped from revised agreement with Crater Lake.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Emery 1988; Hitchcock et al. 1969

K L A M A T H K N O T W E E D

F L E E C E F L O W E R

BRIEF DESCRIPTION OF NATIVE HABITAT: Open slopes and ridges at 5,000-7,500 ft. in Mt. Rainier and Crater Lake national parks; well-drained soil. Found in abundance on "pumice flats" at Crater Lake and at Sunrise Meadows in Mt. Rainier National Park.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Root pieces, cuttings (susceptible to aphids), seed

SEED MATURITY DATE: August (1991), July (1992) at Crater Lake

NUMBER OF SEEDS PER POUND: Undetermined. Less than 500 seeds had been collected as of May 1993.

PERCENT GERMINATION: One observational seeding of 25 seeds in fall 1991 at Crater Lake yielded 3 seedlings by spring 1992; none survived through summer.

EASE OF COLLECTION: Hand collected, very difficult to accumulate seed due to low seed set (Crater Lake, 1991 and 1992). Large root pieces easily dug from pumice soils, placed directly into moist peat/sand.

METHOD OF CLEANING: Small amount of seed collected was lightly hand-rubbed and blown to remove dried leaf flower remnants.

STORAGE REQUIREMENTS: Air-dried seed has been stored in cool room (50 to 72°F) since fall 1991.

ESTIMATED PROPAGULE STORAGE POTENTIAL: At least 10 months (over winter) for large roots stored in moist peat/sand at 40°F.

PROPAGATION METHOD: Sections of large crowns divided by cutting into approx. 15-35 g. pieces with at least one visible bud.

PRETREATMENT USED: None

METHOD OF GROWING: Plant pieces into well-drained mix such as peat, sand, and vermiculite in pots. Observational planting in 1992 in greenhouse kept over winter; good survival/regrowth noted as of May 1993. Seeding may be impractical because of low seed availability.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Few or no seeds found on plants in 1991 and 1992. Locate large storage roots in fall by presence of dried foliage at soil surface.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Noted above.

RE-ESTABLISHMENT TECHNIQUES: Observational seeding showed that direct seeding is possible; also proposed to Crater Lake that root crowns could be dug up and stored from areas scheduled for construction disturbance, to be divided and replanted in containers or directly into reclamation sites in subsequent growing season. **Current status:** This species was deleted from revised contract with Crater Lake National Park; seed will be retained in storage for duration of contract but no further research is planned.

CENTER NAME: Corvallis Plant Materials Center

Potentilla glandulosa Lindl.

STICKY CINQUEFOIL

P. arguta Pursh

WHITE CINQUEFOIL

Argentina anserina (L.) Rydb. (*P. anserina* L.)

SILVERWEED CINQUEFOIL

P. gracilis Dougl. ex Hook.

NORTHWEST CINQUEFOIL

BRIEF DESCRIPTION OF NATIVE HABITAT: Open grasslands--is an increaser on heavily grazed areas. Will colonize on disturbed sites such as pocket gopher mounds.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/15 - 9/15 (*P. glandulosa* and *P. gracilis*)

NUMBER OF SEEDS:

PER POUND:

<i>P. glandulosa</i>	<i>P. arguta</i>	<i>P. anserina</i>	<i>P. gracilis</i>
1,100,000	3,200,000	1,300,000	2,600,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Relatively easy in dense stands; seeds retain well in capsule.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Seed viability good for at least 5 years.

PROPAGATION METHOD: Data not available at date of publication.

PRETREATMENT USED: None

C I N Q U E F O I L (cont.)

METHOD OF GROWING: Establish in seed production fields; harvest with combine, plot harvester, or hand stripping.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Relatively easy to produce seed.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Seed in grass/forb mixtures

CENTER NAME: Bridger, MT Plant Materials Center

Prunus angustifolia Marsh
CHICKASAW PLUM

BRIEF DESCRIPTION OF NATIVE HABITAT: Sandy savannah range site--tall and mid-gass community-- 87% grasses, 3% forbs, 10% woody species; and Eroded Prairie range site--mid/tall-grass community-- 96% grasses, 3% forbs, 1% woody species.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: May-July

NUMBER OF SEED PER POUND: 1,030

PERCENT GERMINATION: Low, due to much under-ripened fruit potential (60%)

EASE OF COLLECTION: Collect fully mature fruits by hand stripping or allow to fall, then collect.

METHOD OF CLEANING: Use macerator to remove pulp.

STORAGE REQUIREMENTS: Excessive drying can be detrimental. Low temperature, closed container to maintain moisture in seed--33°-54°F temperature range.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed

PRETREATMENT USED: Stratification in wet sand or sphagnum moss for 60 days in refrigerator.

METHOD OF GROWING: Field nursery, sow seed in spring with 1/2 - 3/4 inch of topsoil. Firm beds--protect from rodents.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Bed lifter to extract bare-root plants.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Manage bare-root plants in shaded, damp area--treat with fungicide prior to healing in.

RE-ESTABLISHMENT TECHNIQUES: Plant bare-root seedlings in spring or fall; avoid hot, dry months. Use native soil from site, root dip with fungicide or moisture-holding additive as needed.

CENTER NAME: Knox City Plant Materials Center

REFERENCES: Nokes 1986, 290-92; U.S. Dept. of Agriculture 1974, 658-673; Vines 1960, 397-98.

Ptilagrostis kingii (Boland.) Barkworth
(Oryzopsis kingii (Boland.) Beal)

KING'S RICE GRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Subalpine, alpine streambanks and meadows; 8,500-11,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED Maturity DATE: Quantitative values for seed germination could not be found.

NUMBER OF SEEDS PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: (1990) Hand-screened twice using screen size 7 to break up inert and size 1/18 to break off awns. Three runs on small clipper using screens 1/15 top and 1/22 bottom with air closed and taped. Recycled air blowoff and center chute can.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Time-controlled misters used in greenhouse and temperature maintained at 65°-70°F.

PRETREATMENT USED: None required.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Purshia mexicana (D. Don) Henrickson
(Cowania mexicana D. Don)

CLIFF ROSE

BRIEF DESCRIPTION OF NATIVE HABITAT: "United States and Mexico: southern Colorado west to southeastern California, south to Mexico... 3,000-8,000 ft., [in] sunny, dry slopes of mesas or washes...[Prefers] well-drained soil" (Phillips 1949, 99).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Mid-July--August

NUMBER OF SEEDS PER POUND: 64,000

PERCENT GERMINATION: With pretreatment (prechilling seeds for 2 weeks at 5°C), can achieve 55% germination. "Seeds of the May flowering are most viable; those of later flowering are often sterile" (Phillips, 100).

EASE OF COLLECTION: Mature seeds are rapidly dispersed by wind and animals so timing is important. Can be hand stripped or shaken into containers.

METHOD OF CLEANING: Rubbing-threshing and air-screened

STORAGE REQUIREMENTS: Metal containers at room temperature

ESTIMATED PROPAGULE STORAGE POTENTIAL: Up to 7 years

PROPAGATION METHOD: Untreated seed can be sown into seed flats which can then be placed in cold stratification, or seed can be stratified before sowing. Seedlings can be transplanted from seed flats to growing containers.

PRETREATMENT USED: Cold, moist stratification for 2 to 3 months recommended.

METHOD OF GROWING: A well-drained growing medium should be used to help prevent root rot. Seedlings respond well to a constant fertilization program, where approximately 100 ppm nitrogen, phosphorus, and potassium are applied with each watering.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: "Plants should be deep-watered monthly during cold weather to prevent burning" (Phillips, 100). Excellent results have been achieved with "12- to 18-month-old, container-grown stock that was fully hardened off when transplanted" (Young & Young 1992, 124).

CENTER NAME: Los Lunas Plant Materials Center

REFERENCES: Phillips 1949; Young and Young 1992

Quercus gambelii Nutt.

GAMBEL OAK

BRIEF DESCRIPTION OF NATIVE HABITAT: Southwestern Texas north to Colorado, west to southwestern Wyoming, Utah, and southern Nevada and south to Arizona and northern Mexico. Low mountains to foothills; gravel to loamy soils; 4,000-8,000 ft. elevation; 12-24 in. precipitation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Acorns are produced annually. Acorns mature in one year from the time of emergence. Trees tend to be from 8- to 10-inches in diameter before acorns are produced.

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Hand clean

STORAGE REQUIREMENTS: Seeds should not be allowed to dry in storage; therefore, unless a rather sophisticated storage facility is available, seeds should be planted immediately after harvest.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Poor. Plant immediately after collection.

PROPAGATION METHOD: Sow in September and October.

PRETREATMENT USED: Information unavailable

METHOD OF GROWING: Direct plant seed or establish transplants from containers. Transplant into moisture-containing pits and mulch with wood chips. Water regularly. Protect from grazing and rabbit damage.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Direct plant seeds or transplant bare-root material.

CENTER NAME: Meeker Plant Materials Center

Quercus marilandica Muenchh.

BLACK JACK OAK

BRIEF DESCRIPTION OF NATIVE HABITAT: Eroded Prairie range site--mid/tall-grass community-- 96% grasses, 3% forbs, 1% woody species.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed (acorns)

SEED MATURITY DATE: October

NUMBER OF SEED PER POUND: 75 to 256

PERCENT GERMINATION: Approximately 75%-80%

EASE OF COLLECTION: Monitor seed on tree closely; collect as soon as acorns can be removed from caps--avoid letting seed fall to ground. Acorns ripen in two years.

METHOD OF CLEANING: None needed.

STORAGE REQUIREMENTS: Do not let dry out. Stratification in damp sphagnum may be used to hold seed for planting. Keep in 36°-40°F refrigeration. If facilities exist (greenhouse), may be planted after collection.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Low-seed storage potential

PROPAGATION METHOD: Seed into individual pots deep enough to accommodate tap root.

PRETREATMENT USED: May use stratification in damp sphagnum to hold until spring planting.

METHOD OF GROWING: Acorns germinated in seed flats and transplanted into individual containers.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Plant potted seedlings in spring or fall--avoid hot, dry months without providing supplemental water; protect from rodents.

CENTER NAME: Knox City Plant Materials Center

REFERENCES: Dirr and Heuser, Jr. 1987, 185; Nokes 1986, 297-302; U.S. Dept. of Agriculture 1974, 692-703; Vines 1960, 182-83.

Quercus nuttalli E.J. Palmer

NUTTAL OAK

BRIEF DESCRIPTION OF NATIVE HABITAT: Widely distributed on the flood plain of the Red and Mississippi rivers, occasionally on the Prairie Terrace (Brown 1965).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Fruits: August-December

NUMBER OF SEEDS PER POUND: 56 to 143 (USDA 1974)

PERCENT GERMINATION: 60%-69%

EASE OF COLLECTION: Readily accessible

METHOD OF CLEANING: The only extraction required before storage or sowing is removal of loose cups, twigs, and other debris. Proportion of sound seed can be increased by removing defective, hollow, and partially consumed acorns, and by killing weevil larvae inside acorns. Flotation or by hand. Weevil larvae can be killed by immersing the acorns in hot water (120°F for 40 minutes), or by fumigating (ibid.).

STORAGE REQUIREMENTS: Only short storage (6 months) is recommended, or from the time of seed fall to sowing time in the spring. For longer periods, dry storage in sealed containers at $32^{\circ}\text{-}36^{\circ}\text{F}$ has been used, but only with great loss of viability (ibid.).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Poor

PROPAGATION METHOD: Seeded 1/4-1 inch deep. Can be bedded in mulched leaves or straw through the winter and removed in the spring (ibid.).

PRETREATMENT USED: Black oak groups exhibit embryo dormancy, and stratification is recommended before spring sowing. Stratification should be in moist, well-drained sand, sand and peat, or like material for 30 to 90 days at 32° to 41°F (ibid.).

METHOD OF GROWING: Seeding and transplanted to containers.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Container-grown and transplanting

CENTER NAME: None - PMS office Baton Rouge, LA

REFERENCES: Brown 1965; USDA 1974

Quercus stellata Wangenh.

POST OAK

BRIEF DESCRIPTION OF NATIVE HABITAT: Sandy savannah range site--mid/tall-grass community--87% grasses, 3% forbs, 10% woody species; and Eroded Prairie range site--mid/tall-grass community--96% grasses, 3% forbs, and 1% woody species.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed (acorns)

SEED MATURITY DATE: September-November

NUMBER OF SEED PER POUND: 400

PERCENT GERMINATION: Estimated 68%

EASE OF COLLECTION: Monitor seed on tree, collect as soon as acorns can be removed from caps. Acorns ripen in one year. Avoid letting acorns stay on ground very long.

METHOD OF CLEANING: None needed

STORAGE REQUIREMENTS: Do not let dry out. May be held until spring planting by placing acorns in damp sphagnum in closed container and placing in 36-41°F refrigeration.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Low-seed storage potential--less than 6 months.

PROPAGATION METHOD: Seed into individual pots deep enough to accommodate deep tap root.

PRETREATMENT USED: May use damp sphagnum to hold until spring planting.

METHOD OF GROWING: Acorns germinated and grown in deep pots. May be transplanted to larger container for extended storage.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Plant potted seedlings in spring or fall. Avoid hot, dry months without supplemental water. Protect from rodents.

CENTER NAME: Knox City Plant Materials Center

REFERENCES: Nokes 1986, 297-302; U.S. Dept. of Agriculture 1974, 692-703; Vines 1960, 182-83.

Quercus virginiana P. Mill.

L I V E O A K

BRIEF DESCRIPTION OF NATIVE HABITAT: Inhabiting a wide variety of sites having relatively heavy and fertile, well-drained to seasonally wet soils; scattered in mixed woodlands, flatwoods, borders of salt marshes, roadsides, and city lots; commonly scattered in pastures.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Flowers: April. Fruits: Sept.-November.

NUMBER OF SEEDS PER POUND: 240-510 (USDA 1974)

PERCENT GERMINATION: 97% (ibid.)

EASE OF COLLECTION: Readily accessible

METHOD OF CLEANING: The only extraction required before storage or sowing is removal of loose cups, twigs, and other debris. Proportion of sound seed can be increased by removing defective, hollow, and partially consumed acorns, and by killing weevil larvae inside acorns. Flotation or by hand. Weevil larvae can be killed by immersing the acorns in hot water (120°F for 40 minutes), or by fumigating (ibid.).

STORAGE REQUIREMENTS: Only short storage (6 months) is recommended, or from the time of seed fall to sowing time in the spring. For longer periods, dry storage in sealed containers at 32°-36°F has been used, but only with great loss of viability (ibid.).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Poor

PROPAGATION METHOD: Seeded 1/4-1 inch deep. Can be bedded in mulched leaves or straw through the winter and removed in the spring (ibid.).

PRETREATMENT USED: None

METHOD OF GROWING: Seeding and transplanted to containers.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Container-grown and transplanting

CENTER NAME: None - PMS office Baton Rouge, LA

REFERENCES: USDA 1974

Ratidiba columnifera (Nutt.) Woot. & Standl.

PRAIRIE CONEFLOWER

BRIEF DESCRIPTION OF NATIVE HABITAT: This species is not native to the Cumberland Gap area and production was ceased.

BRIEF DESCRIPTION OF NATIVE HABITAT: Production was ceased.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Production was ceased.

SEED MATURITY DATE: Production was ceased.

NUMBER OF SEEDS PER POUND: Production was ceased.

PERCENT GERMINATION: Production was ceased.

EASE OF COLLECTION: Production was ceased.

METHOD OF CLEANING: Production was ceased.

STORAGE REQUIREMENTS: Production was ceased.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Production was ceased.

PROPAGATION METHOD: Production was ceased.

PRETREATMENT USED: Production was ceased.

METHOD OF GROWING: Production was ceased.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Production was ceased.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Production was ceased.

RE-ESTABLISHMENT TECHNIQUES: Production was ceased.

CENTER NAME: National Plant Materials Center

Rhus copallina L.

FLAMELEAF SUMAC,

DWARF SUMAC

BRIEF DESCRIPTION OF NATIVE HABITAT: Deciduous dioecious shrub of the eastern U.S. tolerates dry, sandy, and acidic conditions but thrives on moist sites.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: October - December

NUMBER OF SEEDS PER POUND: 57,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Seed was readily collected on the bay side of Assateague Island, MD. Fruit clusters turn crimson when ripe.

METHOD OF CLEANING: Fruit clusters are lightly run through hammermill, then screened mechanically with moderate air.

STORAGE REQUIREMENTS: *Rhus* sp. seed has good storage potential if humidity is kept low and temperatures are between 32°-41°F.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Currently there is little information as to *R. copallina* storage expectancy.

PROPAGATION METHOD: Fall seeding into raised beds of sandy loam at rate of 3 g./sq. ft. Hand weed; irrigation is one inch biweekly. Transplants are bare-root. Root cuttings will be explored.

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Cape May Plant Materials Center

Rhus copallina L.

WINGED SUMAC

BRIEF DESCRIPTION OF NATIVE HABITAT: Dry woods and clearings. Found from New York, south to Florida, west to Texas, north to Kansas and Wisconsin. It is found at various locations throughout the GSMNP along with other sumac.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September - October (Young & Young 1992, 299)

NUMBER OF SEEDS PER POUND: Approximately 56,750 (ibid.)

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Collection is not difficult. Seed can be hand stripped from the plants from September to November or entire seedhead can be clipped.

METHOD OF CLEANING: Seedheads were broken apart using a hammermill. Seed was cleaned using a rubber roll huller to remove outer seed covering. As seed covering is oily, chaff was not easily separated using clipper fanning mill. Seed and seedcoat chaff were separated by floating off chaff and nonviable seed in water. Seed that sank in water was saved, air dried, and used for planting.

STORAGE REQUIREMENTS: Unknown. Seed was stored in cold storage (relative humidity <50% temp. <50°F).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: 1) Direct seeding to raised bed; 2) greenhouse seedlings transplanted to raised bed.

PRETREATMENT USED: Mechanical scarification for 15 seconds using a Forsberg seed scarifier, hot-water soak prior to greenhouse planting.

METHOD OF GROWING: Seed was scarified and planted to a 1:1:1 peat, perlite, vermiculite potting mix in the greenhouse in January 1992 and planted to 4 inches apart in raised woody bed on 5-14-92. Attempts to plant seed directly to a raised bed on 4-23-92 were unsuccessful. No seed treatment was made on this seed prior to planting; weeds also severe in the bed. Seed was planted to a raised fumigated (methyl bromide) bed 11-19-92; no seed treatment made on this seed. As seed undergoes cold stratification and seedcoat breakdown in the soil during the winter months, we anticipate greater success in this seeding. Seed sown in the spring would probably be more successful if mechanically scarified prior to planting.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: No unique techniques have been determined.

CENTER NAME: Quicksand Plant Materials Center

REFERENCES: Young and Young 1992

Rhus glabra L.

SMOOTH SUMAC

BRIEF DESCRIPTION OF NATIVE HABITAT: Eroded Prairie range site--mid/tall-grass community--96% grasses, 5% forbs, and 3% woody species.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September-November

NUMBER OF SEEDS PER POUND: 68,600

PERCENT GERMINATION: 75%

EASE OF COLLECTION: Hand collect and spread out to dry.

METHOD OF CLEANING: Hand-rubbing or maceration

STORAGE REQUIREMENTS: Cleaned seed may be stored for 2-1/2 years at 32°-41°F in sealed container--avoid drying out.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Up to 2-1/2 years

PROPAGATION METHOD: Seed

PRETREATMENT USED: Acid stratification needed to increase permeability of seed coat.

METHOD OF GROWING: Field planting in late spring into firm seed bed, 1/4-1/2 inch depth. Bare-root management.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Avoid over-watering--damping off may occur; treat seed with fungicide at planting.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Over watering may cause overgrown, growthy plants with large roots and tops which may become planting problems.

RE-ESTABLISHMENT TECHNIQUES: Bare-root seedling may be transplanted in spring. Avoid hot, dry months without supplemental watering.

CENTER NAME: Knox City Plant Materials Center

REFERENCES: Dirr and Heuser, Jr. 1987, 190; Nokes 1986, 307-310; U.S. Dept. of Agriculture 1974, 715-19; Vines 1960, 635-36.

Ribes cereum Dougl.

S Q U A W C U R R A N T

BRIEF DESCRIPTION OF NATIVE HABITAT: Common on eastern slopes of Cascades, B.C. to Oregon and south to S. Calif., east to Montana, Nebraska, and down to New Mexico (Hitchcock et al. 1969). At Crater Lake National Park, on open ridges and slopes; occurs with rabbitbrush, manzanita, dry-meadow forbs and grasses.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, cuttings

SEED MATURITY DATE: August (Young & Young 1992, 303)

NUMBER OF SEEDS PER POUND: Approximately 249,700 (ibid.)

PERCENT GERMINATION: Data not available at date of publication. "The seeds of most species of *Ribes* are highly dormant and require prolonged prechilling, warm stratification followed by prechilling, and/or a wide range of diurnal temperatures during incubation to obtain germination (Genebank Handbook 1985)" (ibid.).

EASE OF COLLECTION: Data not available at date of publication.

METHOD OF CLEANING: Berries depulped in blender with water, strained, and spread out on paper toweling to dry; hand screened to remove remaining dried pulp.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Not determined (seed collected for first time in 1992). Cuttings collected in Sept. '92 and stored for 4 months in moist peat at 38°-40° F remained viable.

PROPAGATION METHOD: Seed stratified for 12 weeks or longer. Cuttings: 2-year-old wood collected in June and rooted in mist bench; prepared with "heels" and dipped in powdered IBA 0.8% concentration; yielded 35% rooted cuttings. Few of the fall-collected and stored cuttings rooted, though all produced shoot growth soon after sticking in propagation bed.

PRETREATMENT USED: 12 to 18 weeks cold-moist stratification of freshly harvested seeds.

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Moderate amounts of woody cuttings can be harvested without damaging plant appearance.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Fall transplanting of containerized stock is planned for Crater Lake revegetation.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969; Young and Young 1992

C R A T E R L A K E C U R R A N T

BRIEF DESCRIPTION OF NATIVE HABITAT: A rather localized species in the Cascade Mts. of southern Oregon (Hitchcock et al. 1969). In Crater Lake, especially in Sun Notch area near the Crater Rim, growing in understory of firs and white-bark pine; scattered patches found elsewhere in park.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seeds, cuttings

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: "The seeds of most species of *Ribes* are highly dormant and require prolonged prechilling, warm stratification followed by prechilling, and/or a wide range of diurnal temperatures during incubation to obtain germination (Genebank Handbook 1985)" (Young and Young 1992, 303).

EASE OF COLLECTION: Berries easily recognized and hand picked.

METHOD OF CLEANING: Berries depulped in blender with added water, strained, and spread on paper toweling to dry; then hand screened to remove dried pulp.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Not fully known; germination of two-year-old seed has fallen off sharply in our collection.

PROPAGATION METHOD: Seeded into flats for transplanting or directly into cone-tainers. Cuttings: One-year-old wood collected in June and treated with 0.8% IBA rooting powder in mist bench yielded a low percentage of rooted cuttings, but root abundance and shoot vigor was rated fair to poor. Stratified seed (seed lot less than one year old) produced high percentage of healthy plants.

PRETREATMENT USED: None noted.

METHOD OF GROWING: Established in greenhouse in cone-tainers in potting mix consisting of peat, perlite, and compost-based organic potting soil. Moved out to lathhouse for summer; transplanted to one-gallon pots in same soil mix and held over winter in lathhouse. Overwintered plants require pruning back to restrain long, horizontal canes. Seedlings may also be started in flats and directly transplanted to one-gallon containers.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Fall transplanting of two-year-old containerized stock is planned for Crater lake. However, one-year-old cone-tainer plugs rather than older plants in one-gallon containers should be considered, as roots and horizontal canes developed very well in the first season.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969; Young and Young 1992

Ribes montigenum McClatchie

SIERRA GOOSEBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Many subalpine, alpine habitats; 7,000-15,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, cuttings

SEED MATURITY DATE: Quantitative values for date of maturity could not be found.

NUMBER OF SEEDS PER POUND: Quantitative values for seed/lb. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: After hand screening, no seed found; may be due to early collection of immature seed.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Can be placed in cold storage for short periods of time.

PROPAGATION METHOD: Cuttings (none rooted): Were propagated into open flats in soil mix of 75% perlite/25% peat moss sterilized at 160° for 24 hours. Bottom heat was set at 70° with misting on 3 seconds at 10-minute intervals and grow lights were on from 5:30 a.m. to 8:30 p.m.

PRETREATMENT USED: Cuttings were dipped into a Hormex and Captan (fungicide) solution of #3 and #16. Seed: 7 to 10 mos. stratification @ 32°F.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Ribes viscosissimum Pursh

STICKY CURRENT

BRIEF DESCRIPTION OF NATIVE HABITAT: Sagebrush, forest; 4,000-10,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Can be placed in cold storage for a short period of time.

PROPAGATION METHOD: Cuttings were propagated into open flats in soil mix of 75% perlite/25% peat moss sterilized at 160° for 24 hours. Bottom heat was set at 70° with misting on 3 seconds at 10-minute intervals and grow lights were on from 5:30 a.m. to 8:30 p.m. These did well in greenhouse, but started to die back once placed in lathhouse. Results with cuttings were poor.

PRETREATMENT USED: Cuttings were dipped into a Hormex and Captan (fungicide) solution of #3 and #16.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Robinia hispida L.

HAIRY LOCUST

BRIEF DESCRIPTION OF NATIVE HABITAT: Plants can be found on dry, well-drained, moist, sunny or shaded areas. In the GSMNP, plants were found on ridges of cliffs on fairly dry soils.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Root cuttings (rhizomes), two inches in length. Very little or no seeds are produced on this species, making seed collection improbable. Root collections were made in January 1993. Depending on success of cuttings, collections are planned for April-May 1993.

EASE OF COLLECTION: Sites with bristly locust are limited in the GSMNP. Roots and rhizomes are very shallow in the ground. One-year-old material was dug or pulled between plants and wrapped in moist packing material and transported in ice chests.

METHOD OF CLEANING: None

STORAGE REQUIREMENTS: Root material needs to stay damp and cool for transport and storage.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Estimate of 1 to 5 days, depending on how it is packaged.

PROPAGATION METHOD: Rhizome cuttings

PRETREATMENT USED: None

METHOD OF GROWING: Success of the following root cutting (rhizomes) method is not known at this time. Rhizome and root material was cut into 2-inch lengths (diameter of material approximately pencil size), sprinkled with a fungicide (Captan/Vitavax), and planted horizontally, approximately 1-inch deep in flats in the greenhouse. Growing medium is 1:1:1 peat, perlite, vermiculite. If successful, rooted material will be planted to a raised bed in the field in the spring of 1993.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: No unique techniques have been determined.

CENTER NAME: Quicksand Plant Materials Center

Rosa acicularis Lindl.

PRICKLY ROSE

BRIEF DESCRIPTION OF NATIVE HABITAT: Found growing among dense under-story shrubs on north-facing slopes.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Fruit

SEED MATURITY DATE: 8/20 - 8/30

NUMBER OF SEEDS PER POUND: 32,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Easy to hand harvest

METHOD OF CLEANING: Dybvig seed cleaner

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Hard seed coat helps seed retain viability for 5 to 10 years.

PROPAGATION METHOD: PMC cleaned only.

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Transplants

CENTER NAME: Bridger, MT Plant Materials Center

Rosa carolina L.

C A R O L I N A R O S E

BRIEF DESCRIPTION OF NATIVE HABITAT: Carolina rose grows on upland sites on roadbanks and idle areas free of very dense vegetation, occurring in open areas and as an understory shrub.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, and rhizomes with an above-ground stem attached.

SEED MATURITY DATE: September - October

NUMBER OF SEED PER POUND: Unknown; probably 40,000-50,000

PERCENT GERMINATION: Poor (from limited experience)

EASE OF COLLECTION: Seeds are quite scarce in the collection area but would be easy to collect if it were plentiful. The hips should be collected soon after they begin to turn from green to red (Gill and Pogge 1974). Rhizomes are limited in number, and digging and potting them is time-consuming.

METHOD OF CLEANING: Rose hips are crushed and washed to remove some material. The seed is then dried and screened to remove as much trash as possible.

STORAGE REQUIREMENTS: Store dry in sealed containers at 38°-48°F if not to be planted the next spring (ibid.).

ESTIMATED PROPAGULE STORAGE POTENTIAL: 2 to 4 years (ibid.)

PROPAGATION METHOD: Propagation from the very few seeds available has been unsuccessful to date. A good percentage of the rhizomes have survived after being potted in a good container-growth medium. Some plants can be divided after they have grown one season.

PRETREATMENT USED: Seed was stratified in a damp mixture of ground peat moss and vermiculite at about 40° for about 90 days. Little germination has occurred.

METHOD OF GROWING: Potted rhizomes need to be grown 2 years in order to reach good plantable size.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: James L. Whitten Plant Materials Center

REFERENCE: Gill and Pogge 1974

VIRGINIA ROSE

BRIEF DESCRIPTION OF NATIVE HABITAT: Deciduous brushy shrub with straight or curved infrastipular spines, found east of the Mississippi River.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: October - November. At maturity the green hip turns red.

NUMBER OF SEEDS PER POUND: 60,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Most common of the wild roses. Although this species is often found in colonies, fruit are normally sparse.

METHOD OF CLEANING: Sun dry for one week, then run through a hammermill; finish by mechanically screening with moderate air.

STORAGE REQUIREMENTS: Low humidity at 34°-38°F.

ESTIMATED PROPAGULE STORAGE POTENTIAL: 2 to 4 years

PROPAGATION METHOD: Fall seeding into raised beds of sandy loam at rate of 3 g./sq. ft. Hand weed; irrigation is one inch biweekly. Transplants are bare-root.

PRETREATMENT USED: Stratification for a minimum of 30 days @ 40°F has performed well.

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Cape May Plant Materials Center

NORTHERN DEWBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Deciduous trailing shrub with sparse spines found south and east of Minnesota on dry soils.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: June - July. Yellowish-white fruit turns black when ripe and mature.

NUMBER OF SEEDS PER POUND: 131,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Dense colonies found on Assateague Island, MD.

METHOD OF CLEANING: Immediately after harvesting, fruit should be macerated in water, then with additional water, allowing the pulp and empty seed to float, where they are removed and discarded. Follow by sun drying.

STORAGE REQUIREMENTS: Cold storage <41°F.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Fall seeding into raised beds of sandy loam at rate of 1.8 g./sq. ft. Hand weed; irrigation is one inch biweekly. Transplants are bare-root. Currently observing stem cuttings with no rooting hormones.

PRETREATMENT USED: 90/90-day warm/cold stratification; with 20 to 60 min. sulfuric acid treatment, germination improves.

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Stem cuttings must be taken while parent plant is dormant.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Cape May Plant Materials Center

Rubus parviflorus Nutt.

THIMBLEBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Wooded or forested areas, wide range of soils and moisture--often established on old road cuts and fills.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Fruit

SEED MATURITY DATE: 8/25 - 9/10

NUMBER OF SEEDS PER POUND: 204,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Relatively easy if you can resist eating.

METHOD OF CLEANING: Dry fruit and rub to break into individual seed.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Seed remains viable for at least 5 years.

PROPAGATION METHOD: PMC has only cleaned.

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Transplants

CENTER NAME: Bridger, MT Plant Materials Center

Sabal minor (Jacq.) Pers.

PALMETTO

BRIEF DESCRIPTION OF NATIVE HABITAT: Widely distributed in Louisiana. Most abundant in southern Louisiana on alluvial soils and river flood plains. Occasionally in the sandy pine hills of eastern and northern Louisiana (Brown 1965).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed and seedlings

SEED MATURITY DATE: Flowers: May-July. Fruits: Sept.-November.

NUMBER OF SEEDS PER POUND: Unknown for *S. minor*; however, other species of *Sabal* average 1,447 seeds per pound (USDA 1974).

PERCENT GERMINATION: Unknown for *S. minor*; however, other species of *Sabal* have shown 84%-95% germination (ibid.).

EASE OF COLLECTION: Moderately accessible

METHOD OF CLEANING: Picked by hand, seed separated from the pulp by running through a macerator or rubbing them on hardware cloth.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seeding in light textured soil, 1/2-1 inch deep. Seed should not be permitted to dry.

PRETREATMENT USED: Unknown for *S. minor*; tests on other species of *Sabal* have shown that no pretreatment to break dormancy was necessary. However, a 30-day stratification in moist sand at 38°F increases the speed of germination.

METHOD OF GROWING: Container materials from seedlings obtained from both seed and vegetative materials.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Container-grown and transplanting

CENTER NAME: None - PMS office Baton Rouge, LA

REFERENCES: Brown 1965; USDA 1974

Salix orestra Schneid.

SIERRA WILLOW

BRIEF DESCRIPTION OF NATIVE HABITAT: Subalpine and alpine meadows; 7,000-13,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings

SEED MATURITY DATE: Data unavailable at date of publication.

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

STORAGE REQUIREMENTS: Seed: 4 to 6 weeks

ESTIMATED PROPAGULE STORAGE POTENTIAL: Can be stored for a short period of time.

PROPAGATION METHOD: Cuttings received in flats were transplanted into cone cells in UCD mix of perlite, peat, vermiculite, sand, and Osmocote (50-50 peat-vermiculite mix had poor drainage). These were placed on bottom heat at 70°F soil temp, misting set for 4 seconds at 6-minute intervals, later changed to 4 seconds at 10-minute intervals. Cuttings received in cone cells were placed in lathhouse and fertilized with Osmocote. The latter cuttings, left in lathhouse for entire winter, had better performance than cuttings rooted in greenhouse. Results with cuttings were poor.

PRETREATMENT USED: Hormone

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Salvia lyrata L.

LYRE-LEAFED SAGE

BRIEF DESCRIPTION OF NATIVE HABITAT: Lyre-leaved sage occurs along roadsides, in lawns, and in other areas which are regularly mowed. It grows on well-drained to reasonably moist sites.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: May

NUMBER OF SEED PER POUND: 350,000

PERCENT GERMINATION: 54% (one test)

EASE OF COLLECTION: Mature seed falls from plants when they are disturbed, so care in hand harvesting is needed to prevent seed loss. Plants must be carefully cut and threshed, or seeds can be shaken from plants into a box or bag. Harvest is not difficult, but it is time-consuming.

METHOD OF CLEANING: Seed can be cleaned with an air-screen cleaner.

STORAGE REQUIREMENTS: Store in a cool, dry place.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Several years

PROPAGATION METHOD: Plant seed on or near the surface of a well-prepared, firm seedbed. Plant 1-2 lbs. per acre in rows or 3-4 lbs. broadcast. Early summer seems to be the best planting time.

PRETREATMENT USED: None has been used.

METHOD OF GROWING: Plant seed as in "Propagation Method." Stands tend to be thin the first year, but improve the second year after seed from established plants shatters or is lost in harvest.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Seed may be direct combined, but timing is important. Flowering and seed maturity is indeterminate, and seed shatters easily. Harvesting shortly after the first seed begins to shatter is probably the best time.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Techniques for re-establishment are not well known, but a study involving inter-seeding is under way. Plantings into mowed areas or firm seedbeds from spring to fall may be successful. Full stands may require two or more years to develop. Regular mowing of the area planted reduces competition and is not harmful to the lyre-leaved sage.

CENTER NAME: James L. Whitten Plant Materials Center

Sambucus canadensis L.

ELDERBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Well-drained, moist, sunny or shady areas. Found in the GSMNP along creeks, mostly low, moist locations.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Berries

SEED MATURITY DATE: June - September (Young & Young 1992, 313)

NUMBER OF SEEDS PER POUND: Approximately 231,550 (ibid.)

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Collection was not difficult. Umbels were clipped from plants. However, it was difficult to reach some fruit, as it overhangs creeks.

METHOD OF CLEANING: Berries were hand stripped from umbels. To remove seed from berries, berries were depulped using a food blender filled partially with water. The mixture was then hand screened. Empty seeds and debris were separated from viable seed by floating off in water.

STORAGE REQUIREMENTS: Unknown. Seed was stored in cold storage (relative humidity <50% temp <50°F).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed

PRETREATMENT USED: None. Action in the food blender may have mechanically scarified seed. Fall planting may also contribute to success because of cold stratification and seedcoat breakdown.

METHOD OF GROWING: Seeds were planted 1/2-inch deep approximately 4 inches apart in a raised fumigated bed (methyl bromide) in November. Bare-root stock is optimum size after one growing season.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: No unique techniques have been determined.

CENTER NAME: Quicksand Plant Materials Center

REFERENCES: Young and Young 1992

Sambucus racemosa ssp. *pubens* (Michx.) House

RED ELDERBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Moist areas; 6,000-10,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings

SEED MATURITY DATE: Data unavailable at date of publication.

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Cuttings received in flats were transplanted into cone cells in UCD mix of perlite, peat, vermiculite, sand, and Osmocote (50-50 mix of peat/vermiculite had poor drainage). These were placed on bottom heat at 70°F soil temperature; misting was set for 4 seconds at 6-minute intervals, later changed to 4 seconds at 10-minute intervals. Potted cuttings received in cone cells were placed in lathhouse and fertilized with Osmocote. The latter, left in lathhouse for entire winter, had better performance than cuttings rooted in greenhouse. Results with cuttings were poor.

PRETREATMENT USED: Hormone

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Sambucus racemosa L. ssp. *pubens* (Michx.) House
var *arborescens* (Torr. & Gray) Gray
(*Sambucus racemosa* L. var. *arborescens* Torr. & Gray)

RED ELDERBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Commonly low to moderate elevations; Alaska to Calif., Cascade range to coast (Hitchcock et al. 1969). At Crater Lake National Park., on moist soils at base of cliffs, protected areas.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings, seed

SEED MATURITY DATE: End of August to mid-September

NUMBER OF SEEDS PER POUND: 212,000-286,000

PERCENT GERMINATION: Generally low: 0% without stratification; literature reports up to 20% germination with extended warm/cold stratification regimes.

EASE OF COLLECTION: Berries and cuttings easily obtained.

METHOD OF CLEANING: Berries depulped in blender with water; strained and dried on paper toweling. Hammermill, 1/8" screen to break apart dried pulp/seed; air-screened #6 round screen, medium air flow.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Cuttings were treated and placed in vermiculite in a mist bed (with 60% shade) for several weeks (length of time dependent upon species). Current season cuttings not treated with IBA exhibited fair root production, 30% survival, and little new growth.

PRETREATMENT USED: Varied: 1) 1-year-old or current season's growth + 0.8% IBA powder dip; 2) 1-year-old or current season's growth w/o IBA; 3) Older growth + 0.8% IBA powder dip; 4) Older growth w/o IBA.

METHOD OF GROWING: Well-rooted cuttings transplanted into one-gallon pots containing peat/perlite/compost-based potting soil mix; maintained over winter in lathhouse.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted

RE-ESTABLISHMENT TECHNIQUES: Fall transplanting of container-grown stock is planned for Crater Lake revegetation projects.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Sapindus drummondii Hook & Arn.

W E S T E R N S O A P B E R R Y

BRIEF DESCRIPTION OF NATIVE HABITAT: Shallow, sandy bottomland sites.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September-December

NUMBER OF SEEDS PER POUND: 1,160

PERCENT GERMINATION: 75%

EASE OF COLLECTION: Hand picking or flailing it from tree

METHOD OF CLEANING: Maceration in water

STORAGE REQUIREMENTS: May use low temperature in closed container to increase longevity.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed

PRETREATMENT USED: Allow seed, after maceration, to soak in pulp and water for 30 to 60 days in low temperature--36°-54°F.

METHOD OF GROWING: Sow seed in flats, transplant into individual containers or use bare-root stock; treat seedlings with fungicide to prevent damping off.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Transplant potted or bare-root seedlings in the spring or fall.

CENTER NAME: Knox City Plant Materials Center

REFERENCES: Nokes 1986, 319-20; U.S. Dept. of Agriculture 1974, 558-759; Vines 1960, 683, 684.

Sassafras albidum (Nutt.) Nees

S A S S A F R A S

BRIEF DESCRIPTION OF NATIVE HABITAT: Massachusetts to Michigan, south to northern Florida and east Texas, and west to Missouri. Moist, well-drained, open woodlands.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Fruit + seed

SEED MATURITY DATE: August - September

NUMBER OF SEEDS PER POUND: 5,900

PERCENT GERMINATION: Varies considerably.

EASE OF COLLECTION: Hand collect. Birds eat mature fruit.

METHOD OF CLEANING: Pulp fruits in water to extract seed.

STORAGE REQUIREMENTS: 40°F, 35% RH in polyethylene bags

ESTIMATED PROPAGULE STORAGE POTENTIAL: Several years if in sealed containers

PROPAGATION METHOD: Seed

PRETREATMENT USED: 120 days moist, cold stratification

METHOD OF GROWING: Sow in pots. Plants are being container-grown as they are difficult to transplant bare root.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Plants are container-grown.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: National Plant Materials Center

REFERENCE: Young and Young 1992, 317

Shepherdia canadensis (L.) Nutt.

RUSSET BUFFALO BERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: "Dry, sandy or stony, calcareous soil, Nf. to Alaska, south to N.Y., n. Indiana, and S. Dakota, and in the west to New Mexico and Arizona" (Gleason 1963, 2:574).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: June through August (typically, late July)

NUMBER OF SEED PER POUND: 52,000 (for our collections)

PERCENT GERMINATION: Highly variable, from <20%-80%

EASE OF COLLECTION: Fruit collected when turned red; achenes stripped from plant or collected off ground.

METHOD OF CLEANING: We run fruit through a Dybvig (macerator) and spread pulp out to dry. Pulp hand rubbed and run over office clipper.

STORAGE REQUIREMENTS: Short-term storage of fruit in open plastic bags under cool-dry conditions. We store dried seed in paper envelopes at about 60°F in basement.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seeding

PRETREATMENT USED: Acid scarification (with H_2SO_4) for about 20 minutes plus 60 to 90 days of cold chilling. Tests with 250 ppm GA₃ with and without cold chilling indicate that this species is very responsive to this pretreatment. These tests were done with small lots of seed and need to be performed under more controlled conditions to determine the exact gain.

METHOD OF GROWING: Pretreatments and cone-tainers in greenhouse or fall field planting.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Bridger, MT Plant Materials Center

REFERENCES: Gleason 1963

Sisyrinchium angustifolium P. Mill.

BLUE-EYED GRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Blue-eyed grass occurs on roadsides, lawns, and idle areas which are regularly mowed. It is tolerant of reasonably moist situations.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: May - June

NUMBER OF SEED PER POUND: 750,000 estimate

PERCENT GERMINATION: Unknown, but fair in greenhouse

EASE OF COLLECTION: Seed collection is difficult and very time-consuming. Seed capsules must be almost ready to split and shatter the seed before the seed is mature enough to germinate. Hand harvesting is the only harvest technique which has been successful.

METHOD OF CLEANING: Crush capsules, and then clean with an air-screen machine.

STORAGE REQUIREMENTS: Unknown; probably cool, dry conditions.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Probably a few years.

PROPAGATION METHOD: Direct seeding into a well-prepared seedbed in late summer has resulted in very poor stands. A limited number of plants have been produced by seeding into flats in a greenhouse, transplanting into cell packs and then into a production field. This greenhouse production method would be very labor-intensive for the establishment of a full-scale production field.

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: No method other than hand-harvesting has yet been successful. Low growth, indeterminate seed maturity, and small seed make hand harvesting of even a few pounds of seed impractical.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Unknown; no references on direct seeding into the field have been found.

CENTER NAME: James L. Whitten Plant Materials Center

Smilax rotundifolia L.

C O M M O N G R E E N B R I A R

BRIEF DESCRIPTION OF NATIVE HABITAT: Eastern North America, over a wide variety of habitats

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: October

NUMBER OF SEEDS PER POUND: 15,000-16,000

PERCENT GERMINATION: Fair

EASE OF COLLECTION: Hand collect

METHOD OF CLEANING: Macerate, then dry seed

STORAGE REQUIREMENTS: 40°F, 35% RH in polyethylene bags

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed

PRETREATMENT USED: 86 days cold, moist stratification; little information is available on the propagation of this species.

METHOD OF GROWING: Sow in flats in the greenhouse, outplant to the field.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: National Plant Materials Center

Solidago canadensis L.

CANADA GOLDENROD

BRIEF DESCRIPTION OF NATIVE HABITAT: Open meadows and parks; often pioneer species on disturbed sites such as pocket gopher disturbances, road cuts, etc.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/20 - 10/20

NUMBER OF SEEDS PER POUND: 2,000,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Must collect large volume of seedheads to get a few small seeds.

METHOD OF CLEANING: Thresh with hammermill, run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Seed viability good for up to 5 years.

PROPAGATION METHOD: Establish in cone-tainers; establish in seed production field.

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Transplants. Broadcast seed in grass/forb mixtures.

CENTER NAME: Bridger, MT Plant Materials Center

Solidago canadensis L.

GOLDENROD

CANADA GOLDENROD

BRIEF DESCRIPTION OF NATIVE HABITAT: A widespread, highly diverse species throughout much of North America, with several semi-distinctive regional and ecological varieties. It frequently forms dense colonies in both upland and lowland sites. Occurs in damp and dry open places, often in loose soils, and in clearings in wooded areas.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed (achene) and rhizomes.

SEED MATURITY DATE: Fall

NUMBER OF SEEDS PER POUND: Small seed size--up to 1.3 million seeds per pound.

PERCENT GERMINATION: Conflicting reports concerning germination potential.

EASE OF COLLECTION: Seed stripped from plant inflorescences.

METHOD OF CLEANING: Utilized rub board to hand clean and extract achenes from inflorescence. Hand-screened product with 1/24 box screen. Small inert material removed with the South Dakota seed blower. Seed lot purity not very good, many stems and other inert materials approximately the same size as achenes in seed lot.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed or division. Germination requirements not studied to any degree.

PRETREATMENT USED: Seed may require stratification period to germinate at full potential.

METHOD OF GROWING: Data unavailable at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Can be divided and transplanted in fall or spring.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None known.

RE-ESTABLISHMENT TECHNIQUES: Data unavailable at date of publication.

CENTER NAME: Manhattan Plant Materials Center

REFERENCES: Great Plains Flora Association 1986; Liberty Hyde Baily Hortorium Staff 1976; Weaver 1954.

Solidago sempervirens L.

SEASIDE GOLDENROD

BRIEF DESCRIPTION OF NATIVE HABITAT: Erect perennial herb with showy yellow flowers native to the Atlantic and Gulf of Mexico coastlines, inhabiting coastal.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: November - December. Seed is mature when yellow flower rays become fluffy and white in color.

NUMBER OF SEED PER POUND: 772,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Common along Mid-Atlantic coast. Entire seed cluster is harvested, and non-seed material is difficult to separate.

METHOD OF CLEANING: Entire seed cluster is hammermilled, then mechanically screen cleaned with no air.

STORAGE REQUIREMENTS: Seed, in packets or cloth sacks, are placed in de-humidified storage at temperatures <40°F.

ESTIMATED PROPAGULE STORAGE POTENTIAL: At least four years of good viability.

PROPAGATION METHOD: Field seeding in sandy loam at rate of .15 lbs./ac. Hand weed; irrigation is one inch biweekly. Transplants are in peat pots.

PRETREATMENT USED: None

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Cape May Plant Materials Center

Sorbus scopulina Greene

MOUNTAIN ASH

BRIEF DESCRIPTION OF NATIVE HABITAT: Alaska to northern Calif., east to Dakotas, south to New Mexico; in Northwest from foothills to near-alpine habitat (Hitchcock et al. 1969). At Crater Lake, a few solid stands near headquarters buildings. Not widely distributed in park.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, cuttings

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: Data not available at date of publication. "Sorbus seeds require 60 days or more prechilling for germination. Warm stratification before prechilling does not enhance germination" (Young and Young 1992, 327).

EASE OF COLLECTION: Bright berries in large clusters easily identified and collected. Modest amount of cuttings can be obtained without obvious signs of collecting/pruning.

METHOD OF CLEANING: Berries depulped in blender with added water; seed and pulp dried on paper toweling. Dried seed and pulp run through hammermill, 3/8" screen to break apart, then air-screened with #8 screen, moderate air flow.

STORAGE REQUIREMENTS: "For best results, storage in sealed containers at 6%-8% moisture content and low temperatures is recommended" (ibid.).

ESTIMATED PROPAGULE STORAGE POTENTIAL: "Cleaned seeds can be stored for 2 to 8 years with little loss of viability" (ibid.).

PROPAGATION METHOD: Cuttings of one-year-old summer wood with 'heels' produced a low yield (15%) of rooted plants. Seeds stratified for 90 days did not germinate. Further seed propagation trials are planned for 1993 to 1995 at the Corvallis PMC.

PRETREATMENT USED: None noted.

METHOD OF GROWING: Rooted cuttings were planted in one-gallon containers with peat/perlite/organic compost-based soil mix. After establishment plants were moved to lathhouse and remained outside over winter.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Seeds should be removed from berries as soon as possible because pulp contains germination inhibitors.

RE-ESTABLISHMENT TECHNIQUES: Fall transplanting of container-grown stock is planned for Crater Lake revegetation project.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969; Young and Young 1992

Spirea splendens Baumann ex K. Koch var. *splendens*
(*Spirea densiflora* Nutt. ex Greenm.)

ALPINE SPIREA

BRIEF DESCRIPTION OF NATIVE HABITAT: Mountains of western North America up to 11,000 ft., along streams and lakes or on wooded or open rocky slopes (Hitchcock et al. 1969). At Crater Lake, along streams in gravelly areas, at base of talus slopes.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, cuttings

SEED MATURITY DATE: End of August to September

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: Not tested: cone-tainers seeded at 5-8 seeds/cone had to be thinned due to heavy germination.

EASE OF COLLECTION: Hand harvested, seedheads easily picked by hand; cuttings can be collected unobtrusively from established shrubs.

METHOD OF CLEANING: Hammermill with 1/8" screen; air-screen with #8 round screen, medium-low air flow.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Direct seed into cone-tainers, or root one-year-old summer-active cuttings in mist bench.

PRETREATMENT USED: 48 days cold-moist stratification; seeds also germinate satisfactorily with no pretreatment.

METHOD OF GROWING: Transplant well-developed cone-tainer plants to one-gallon pots after one year, or transplant well-rooted cuttings directly into one-gallon pots. Maintained in lathhouse over winter at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted

RE-ESTABLISHMENT TECHNIQUES: Fall transplanting of containerized stock is planned for Crater Lake revegetation.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Sporobolus contractus A.S. Hitchc.

SPIKE DROPSEED

BRIEF DESCRIPTION OF NATIVE HABITAT: Data unavailable at date of publication.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Data unavailable at date of publication.

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Data unavailable at date of publication.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Data unavailable at date of publication.

PRETREATMENT USED: Data unavailable at date of publication.

METHOD OF GROWING: Data unavailable at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: Data unavailable at date of publication.

CENTER NAME: Los Lunas Plant Materials Center

Stipa nelsonii Scribn.

COLUMBIAN NEEDLEGRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Dry plains, meadows, and open woods; <7,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Quantitative values for date of maturity could not be found.

NUMBER OF SEEDS PER POUND: Quantitative values for seed/lb. date of maturity, etc. could not be found.

PERCENT GERMINATION: Quantitative values for seed germination could not be found.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: (1990) Hand-screened once with size 12 screen to scalp off large inert. Screened 3 more times with size 1/12 screen. Cleaned 3 times on small clipper using 1/12 top and 1/22 bottom screens with 20% air. Last run switched bottom screen to blank. Seed does not hammer well as keeps matting and won't push through screen; also doesn't clean well--separation of inert from seed is difficult as seed is very light and blows off with it. Did not do well in scarifier to remove awns.

STORAGE REQUIREMENTS: Longevity of seed unknown. No known special storage requirements.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: (Germination in lathhouse greatly increased over germination in greenhouse.) Time-controlled misters used in greenhouse and temperature maintained at 65°-70°F.

PRETREATMENT USED: None required.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Stipa nelsonii Scribn. ssp. *dorei* Barkworth & Maze
(*Stipa columbiana* auct. non Macoun)*

COLUMBIA NEEDLEGRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Alberta to Washington, south to Colorado and Baja California. Dry plains, meadows, and open woods at medium elevations; 6,000-9,000 ft. elevation; 16-20 in. precipitation.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: July

NUMBER OF SEEDS PER POUND: 150,000

PERCENT GERMINATION: 20%-30%

EASE OF COLLECTION: Data unavailable at date of publication.

METHOD OF CLEANING: Air screen cleaner

STORAGE REQUIREMENTS: Cool, dry storage (33°-45°F)

ESTIMATED PROPAGULE STORAGE POTENTIAL: 2 to 5 years

PROPAGATION METHOD: Seed

PRETREATMENT USED: KNO3, if less than two-years old

METHOD OF GROWING: If the seed is less than two years old, it should be planted in the late fall or prechilled in KNO3 for planting the following year. Older seed can be seeded in the early spring. Seed should be planted 3/4-inch deep in medium textured soils. At least 6 lb. PLS per acre is recommended.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Preferable to use a flail-vac harvester and collect over time.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Debearder required for seed.

RE-ESTABLISHMENT TECHNIQUES: Direct plant seed 3/4-inch deep in fall or spring, depending on seed age.

CENTER NAME: Meeker Plant Materials Center

*The *Stipa* species that we are propagating for Grand Teton National Park may not be *S. nelsonii* spp. *dorei*. Taxonomic confirmation is being carried out by the UCEPC.

Stipa occidentalis Thurb. ex S. Wats

WESTERN NEEDLEGRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Grasslands, sagebrush desert to ponderosa and subalpine forests and ridges; Yukon/B.C. to southern Calif., east to Dakotas, south to New Mexico (Hitchcock et al. 1969). In Crater Lake, in dry, open meadows or in partially wooded areas near old roads, clearings.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Late August, early September at Crater Lake (have not produced seed at PMC yet--as of May '93).

NUMBER OF SEEDS PER POUND: 311,000 (Note: These seeds are small, slender, and very dense/heavy for their size.)

PERCENT GERMINATION: 28% (using 2-day prechill). Note: AOSA seed testing rules for other *Stipa* species specify special procedures to test germination/dormancy.

EASE OF COLLECTION: Hand harvested--moderately slow (low volume seed-heads).

METHOD OF CLEANING: Threshed with Kamman/Westrup Brush machine, #8 mantle (seed falls through screen), followed by de-awning with #12 mantle brush; then air-screened with #6 screen, medium air flow.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: May be directly seeded into cone-tainers (5-8 seeds/cone, planted shallow) in greenhouse. Cones may be left outdoors in spring first week after planting to provide natural chilling before moving into greenhouse.

PRETREATMENT USED: None noted.

Stipa occidentalis

WESTERN NEEDLEGRASS (cont.)

METHOD OF GROWING: Direct field seeding in spring produced poor results because the small, slender seedlings were easily overtaken by weeds. No selective herbicides available to control contaminant grass weeds. Fall sowing with carbon banding tried in fall 1992: very few seedlings emerged in spring '93, and these are being crowded out by weedy grasses (esp. *Poa annua*) that emerged within the carbon band row. PMC continuing to work on agronomic practices to improve stand establishment.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Awns require brushing to remove; brush machine works well if sufficient volume and seedheads are very dry.

RE-ESTABLISHMENT TECHNIQUES: Fall seeding planned for Crater Lake. First-year results of revegetation plot study at Crater Lake showed percentage plant cover was reduced under straw mulch but enhanced in plots amended with peat and slow-release fertilizer. All fertilized plots produced 50% or more flowering plants in the first season; non-fertilized plots and straw-mulched plots had less than 1% flowering. Additional data collection is planned for these plots in 1994.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969. Literature review continuing at Corvallis PMC as of May 1993.

Stipa richardsonii Link

RICHARDSON NEEDLEGRASS

BRIEF DESCRIPTION OF NATIVE HABITAT: Open meadows; usually associated with big sagebrush.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 7/20 - 8/20

NUMBER OF SEEDS PER POUND: 218,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Easy to hand strip, but only a few seeds per plant and usually in scattered stands.

METHOD OF CLEANING: Thresh with hammermill (possibly 2-3 times to remove awns), run over office clipper or M2B.

STORAGE REQUIREMENTS: Cool/dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: Hard seedcoat makes storage possible for 5 to 10 years.

PROPAGATION METHOD: Establish in seed production field.

PRETREATMENT USED: None--best to fall plant.

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Because of long awns, needlegrass can be harvested with seed strippers and a Woodward flail-vactTM.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Difficult to process seed to a flowable product.

RE-ESTABLISHMENT TECHNIQUES: Direct seed; mulch with forage harvested when seedheads are mature.

CENTER NAME: Bridger, MT Plant Materials Center

Symphoricarpos oreophilus Gray

ROUNDLEAF SNOWBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Open meadow and parks and along intermittent drainageways.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 8/20 - 9/10

NUMBER OF SEED PER POUND: 53,900

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Relatively easy, because plant retains most of fruit well into fall and early winter.

METHOD OF CLEANING: Dybvig seed cleaner

STORAGE REQUIREMENTS: Cool-dry after fleshy exterior removed

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Bare-root transplants

PRETREATMENT USED: Snowberry requires a warm-cold-warm stratification. Dormant seed may germinate up to two years after seeding. To ensure a warm treatment, the seeded outdoor beds were covered with black plastic following September seeding. The plastic was removed as snow began to cover beds in December.

METHOD OF GROWING: Data not available at date of publication.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Bridger, MT Plant Materials Center

Tridens flavus (L.) A.S. Hitchc.

P U R P L E T O P

BRIEF DESCRIPTION OF NATIVE HABITAT: Purpletop is found in old fields, along roadsides, and in other open areas on upland sites. It occurs early in the stages of plant succession but is not the primary invader. It will persist for a number of years on areas that are maintained artificially in the early stages of plant succession.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: October or November

NUMBER OF SEED PER POUND: 375,000-500,000

PERCENT GERMINATION: Up to 80%

EASE OF COLLECTION: Seed is relatively easy to collect by hand stripping mature seedheads.

METHOD OF CLEANING: Seed can be cleaned with an air-screen cleaner.

STORAGE REQUIREMENTS: Store in a cool, dry area.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Probably a number of years if properly stored.

PROPAGATION METHOD: Plant seed in rows into a clean, firm seedbed. Use a rate of 2-3 lbs. per acre. Plantings may be made in the spring or in the fall. Spring-planted seed needs to be cleaned to bare caryopses or stratified for 90 days at 40°F in order to prevent germination being delayed for a year.

PRETREATMENT USED: Either remove all seed husks to bare caryopses, or stratify seed for 90 days at 40°F.

METHOD OF GROWING: A production field was direct seeded in rows in the spring, using stratified seed.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Seed may be harvested with a combine or with a flail-vacuum harvester.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: The "hulls" or "husks" should be removed from the seed in order to obtain germination the first year when spring plantings are made.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: James L. Whitten Plant Materials Center

Vaccinium cespitosum Michx.

D W A R F B I L B E R R Y

BRIEF DESCRIPTION OF NATIVE HABITAT: Margins of wet meadows, mountain slopes; <11,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings

SEED MATURITY DATE: Data unavailable at date of publication.

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: See *Ledum glandulosum*; cuttings did not root.

PRETREATMENT USED: Data unavailable at date of publication.

METHOD OF GROWING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Vaccinium corymbosum L.

H I G H B U S H B L U E B E R R Y

BRIEF DESCRIPTION OF NATIVE HABITAT: Deciduous branching shrub is commonly found on poorly drained sites in open areas or woods from Maine to Minnesota south to Florida.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: June - August. Pale green fruit with attached blooms turn dark blue when ripe.

NUMBER OF SEED PER POUND: 975,550

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Numerous well-stocked stands were located on Assateague Island, MD. Usually mixed with *Vaccinium atrococcum* (black high-bush blueberry).

METHOD OF CLEANING: After harvesting, fruit should be stored for several days at < 50°F, then macerated with water, adding more water to allow pulp and empty seed to be floated off.

STORAGE REQUIREMENTS: Normal refrigeration

ESTIMATED PROPAGULE STORAGE POTENTIAL: Up to 12 years

PROPAGATION METHOD: Fall seeding into raised beds of sandy loam at rate of .9 g./sq. ft. Hand weed; irrigation is one inch biweekly. Transplants are bare-root.

PRETREATMENT USED: None

METHOD OF GROWING: Use 50% sun/shade during first year.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Cape May Plant Materials Center

Vaccinium elliottii Chapman

ELLIOT'S BLUEBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Understory shrub under both hardwood and mixed pine-hardwood stands, on both bottomland and upland sites.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed; suckers; naturally layered plants; cuttings

SEED MATURITY DATE: Late May - June

NUMBER OF SEED PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Very poor; none has germinated.

EASE OF COLLECTION: Fruit is easy to collect, but quantity is limited. Suckers and layered plants: Can be dug without much difficulty, but the quantity is limited. Cuttings: Are of poor quality. Young twigs are tiny, and lack the vigor necessary to make good cuttings.

METHOD OF CLEANING: Crush and wash fruit. Dry and screen to remove dried pulp and other material.

STORAGE REQUIREMENTS: Store dried seed in cool, dry conditions.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Several years.

PROPAGATION METHOD: Seed which had been cold stratified 90 days and planted in a peat moss medium failed to germinate.

PRETREATMENT USED: None

METHOD OF GROWING: Cuttings: Cuttings have been taken in late February at the break of dormancy, and in July. These were treated with rooting hormone, and placed into a rooting bed. Rooting percentage has been low. According to Hartman and Kester (1975), softwood cuttings of some blueberries should be rooted in a peat moss-perlite rooting medium, and rooted cuttings should remain in the bed until the following spring before being lined out. Suckers and layered plants: These propagules should be potted in a good quality potting mix with pine bark as a component. Additives to lower the pH may be needed.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: James L. Whitten Plant Materials Center

REFERENCE: Hartman and Kester 1975

Vaccinium membranaceum Dougl. ex Torr.

MOUNTAIN HUCKLEBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Mountains, B.C. to Calif., both sides of Cascades, east to Montana and Idaho (Hitchcock et al. 1969). In Crater Lake National Park, growing in moist, semi-open woods.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seeds

SEED MATURITY DATE: August

NUMBER OF SEEDS PER POUND: Not determined--over 1,000,000

PERCENT GERMINATION: Not determined; literature reports for other *Vaccinium* species reports low germination without extended stratification.

EASE OF COLLECTION: Somewhat slow because berries not plentiful (considered a delicacy by wildlife and tourists).

METHOD OF CLEANING: Berries processed in large volumes of water in a blender with dull blades; pulp strained with fine-mesh sieve, seed spread on paper towel-ing to dry.

STORAGE REQUIREMENTS: Seed: cool/dry. Cuttings: may be stored 2 months or more in moist peat in cooler.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Rooting was poor; could be propagated from seed, but seedlings are slow to establish.

PRETREATMENT USED: None tried at PMC.

METHOD OF GROWING: None being grown at PMC.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted

RE-ESTABLISHMENT TECHNIQUES: No plans to continue this species--dropped from revised cooperative agreement with Crater Lake as of 1993.

COMMENTS: Original agreement called for *Vaccinium ovatum*, a coastal, ever-green species that does not occur at Crater Lake National Park
V. membranaceum prefers an acid soil with moisture retention but also good drainage; this species would not be expected to thrive in disturbed soils in reclamation projects.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Vaccinium scoparium Leib. ex Coville

G R O U S E W H O R T L E B E R R Y

BRIEF DESCRIPTION OF NATIVE HABITAT: B.C. to northern Calif., east to South Dakota, Rocky Mts.; usually at mid and higher mountain elevations (Hitchcock et al. 1969). Our collections are from understory areas with moisture-retentive soils and well-developed duff layers, not in exposed, windy, or dry places.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Stem cuttings, root pieces, seed

SEED MATURITY DATE: August

NUMBER OF SEEDS PER POUND: Not determined--well over 1,000,000

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Slow: berries are very small and are a major food source for wildlife; moderate amounts of stem and root cuttings can be taken without leaving obvious signs.

METHOD OF CLEANING: Berries depulped in blender with water; strained through fine mesh sieve, dried on paper toweling.

STORAGE REQUIREMENTS: Seed: cool/dry. Cuttings: can be stored several months in moist peat/duff in cooler.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Cuttings: low success rate with root and stem cuttings. Seeds not tried at PMC.

PRETREATMENT USED: None

METHOD OF GROWING: Plant in rich soil mix; rooted cuttings transplanted to one-gallon pots and held over in lathhouse. AlSO_4 and acid-loving plant fertilizer used on one-year-old container stock to reduce soil pH.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted

RE-ESTABLISHMENT TECHNIQUES: Not planned for Crater Lake; this species was dropped from revised agreement (as of 1993).

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Vaccinium uliginosum L.
(*Vaccinium uliginosum* L. ssp. *occidentale* (Gray) Hulten)

WESTERN BLUEBERRY

BRIEF DESCRIPTION OF NATIVE HABITAT: Bogs, wet meadows; <11,000 ft.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Cuttings

SEED MATURITY DATE: Data unavailable at date of publication.

NUMBER OF SEEDS PER POUND: Data unavailable at date of publication.

PERCENT GERMINATION: Data unavailable at date of publication.

EASE OF COLLECTION: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

METHOD OF CLEANING: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

STORAGE REQUIREMENTS: Data unavailable at date of publication.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Cuttings received in flats were transplanted into cone cells in UCD mix of perlite, peat, vermiculite, sand, and Osmocote (50-50 peat/vermiculite mix had poor drainage). These were placed on bottom heat at 70°F soil temperature; misting was set for 4 seconds at 6-minute intervals, later changed to 4 seconds at 10-minute intervals. Potted cuttings received in cone cells were placed in lathhouse and fertilized with Osmocote. The latter, left in lathhouse for entire winter, had better performance than cuttings rooted in greenhouse. Results with cuttings were poor.

PRETREATMENT USED: Data unavailable at date of publication.

METHOD OF GROWING: Soft wood cuttings are best for most species. Some species can be propagated by leaf cuttings, while other species may best be propagated by seed.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Collection and re-establishment were carried out by Yosemite Nat'l. Park; data not available at PMC.

CENTER NAME: Lockeford Plant Materials Center

Veratrum californicum Dur.

F A L S E H E L L E B O R E

BRIEF DESCRIPTION OF NATIVE HABITAT: Swamps, creeks, moist meadows and woods, lowland to subalpine; western Wash. to Calif., east to Montana, Colorado (Hitchcock et al. 1969). At Crater Lake, in moist soils, open canopy to partial shade, near seeps, in low-lying meadow areas.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: September

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: 0%-2% (planted in soil at 20°C); x-ray testing showed 82% filled seed, 18% empty.

EASE OF COLLECTION: Easily collected in good seed year (1991--seed plentiful; 1992--little or no flowering occurred).

METHOD OF CLEANING: Seeds hand stripped off of stalks: papery 'wings' left attached.

STORAGE REQUIREMENTS: Cool/dry; storage at or below 32°F may extend seed life.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Very short; literature reports one year or less.

PROPAGATION METHOD: Seed propagation: literature reports caution that growth from seeds is very slow and uncertain.

PRETREATMENT USED: 48 days cold-moist stratification; 3 months or longer may improve germination.

METHOD OF GROWING: Stratified seeds produce one small leaf and one tiny bulblet in first season; then long dormant periods in cold stratification between growth periods.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Unidentified *Lepidoptera* larvae infested seedheads in 1991 collection; mothballs added to open seed sacks during drying to repel insects/inhibit seed predation.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Not scheduled for revegetation projects at Crater Lake due to propagation/increase limitations.

CENTER NAME: Corvallis Plant Materials Center

REFERENCES: Hitchcock et al. 1969

Viburnum rufidulum Raf.

RUSTY BLACKHAW

BRIEF DESCRIPTION OF NATIVE HABITAT: Rusty blackhaw is a shrub to small tree found as an understory plant in hardwood stands, and sometimes around forest openings and along fence rows.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Fruit

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Fruiting plants have been difficult to find. Fruits may be collected by picking from the plants or by shaking onto a tarpaulin. About 50% of the fruit collected has had the seed destroyed by some insect.

METHOD OF CLEANING: Fresh fruit should not be allowed to heat (U.S. Dept. of Agriculture 1974). Fruit may be macerated or mashed, and the pulp may then be washed from the seed. Seed should then be dried before storage. The fruit may be dried and stored or planted without removing the pulp from the seed (ibid.).

STORAGE REQUIREMENTS: Cleaned seed or fruit should be dried and stored in sealed containers at 34°-38°F, but extraction of seed from the pulp is recommended because cleaned seed gives higher seed germination in some cases (ibid.).

ESTIMATED PROPAGULE STORAGE POTENTIAL: 8 to 10 years (ibid.).

PROPAGATION METHOD: Seed has been direct seeded into beds. Seedlings will be transplanted into containers for growing out. Seed planted in December 1991 failed to germinate until February 1993. Seed subjected to 90 days warm stratification followed by 90 days cold stratification and then planted in June 1992 also failed to germinate until February 1993.

PRETREATMENT USED: Limited seed stratification procedures tried have not induced seed germination. Dirr and Heuser (1987) recommend a warm stratification period of several months followed by cold stratification for 3 to 4 months.

Viburnum rufidulum

R U S T Y B L A C K H A W (cont.)

METHOD OF GROWING: Seeds are sowed into a bed, and young seedlings are transplanted into containers for growing out for one or more years.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: The most practical means of getting seed germination seems to be by sowing in a bed in either fall or spring, and anticipating that germination will be delayed one year.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: James L. Whitten Plant Materials Center

REFERENCES: Dirr and Heuser 1987; U.S. Department of Agriculture 1974.

Vicia caroliniana Walt.

PERENNIAL VETCH

BRIEF DESCRIPTION OF NATIVE HABITAT: Rich woods and thickets. This plant grows in shady, cool locations within the GSMNP. It can be collected from New York and southern Ontario to Minnesota, south to Georgia, Alabama, Mississippi, Louisiana, and Oklahoma.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEEDS PER POUND: Data not available at date of publication.

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Seed and plants are small and sparse. Amount of seed produced on a plant is minimal, making seed collection slow. Collections at the GSMNP were in June.

METHOD OF CLEANING: Rub board and food blender to remove seed from hull, hand screens and aspirator to remove chaff.

STORAGE REQUIREMENTS: Unknown. Seed was stored in cold storage (relative humidity <50% temp <50°F).

ESTIMATED PROPAGULE STORAGE POTENTIAL: Data unavailable at date of publication.

PROPAGATION METHOD: Seed, greenhouse-grown seedlings planted to field.

PRETREATMENT USED: Mechanical scarification

METHOD OF GROWING: The Quicksand Plant Materials Center has been unsuccessful in producing seed of this species. Attempts to propagate seed were made in 1991 and 1992. Seeds were successfully germinated in the greenhouse in plug trays. Seedlings were transplanted to the field where growth was slow. Plants were susceptible to hot sun and warm temperatures. Attempts to cover plants with shade cloth in the field have been successful in keeping the plants alive, but growth has been slow and no seed has been produced. Scarified seed planted to the field germinated, but plant growth was slow and no seed has been set.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: Data unavailable at date of publication.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: Data unavailable at date of publication.

RE-ESTABLISHMENT TECHNIQUES: No unique techniques have been determined.

CENTER NAME: Quicksand Plant Materials Center

Viguiera multiflora (Nutt.) Blake

S H O W Y G O L D E N E Y E

BRIEF DESCRIPTION OF NATIVE HABITAT: Usually found in disturbed areas, e.g., roadcuts, heavy foot traffic, rodent disturbances.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: 9/5 - 9/20

NUMBER OF SEED PER POUND: 800,000

PERCENT GERMINATION: Data not available at date of publication.

EASE OF COLLECTION: Relatively easy (cut off seedheads with scythe).

METHOD OF CLEANING: Dried seedheads run through hammermill and passed through fanning mill.

STORAGE REQUIREMENTS: Cool-dry

ESTIMATED PROPAGULE STORAGE POTENTIAL: 6 to 8 years

PROPAGATION METHOD: Seeding

PRETREATMENT USED: None

METHOD OF GROWING: Although dormant fall seeding is recommended, it has been established with early spring planting.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: Data not available at date of publication.

CENTER NAME: Bridger, MT Plant Materials Center

Vitis aestivalis Michx.

S U M M E R G R A P E

BRIEF DESCRIPTION OF NATIVE HABITAT: Woods and thickets, vining trees

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: One-year-old vine material

EASE OF COLLECTION: This species is relatively easy to collect. Grape vines are abundant in specific areas of the GSMNP. Finding viable one-year-old vine material, however, could be difficult in some years, depending on previous years' climatic conditions. Some vines are also difficult to reach from the ground when they are vined on tall trees.

METHOD OF CLEANING: None

STORAGE REQUIREMENTS: Cool-moist conditions

ESTIMATED PROPAGULE STORAGE POTENTIAL: Cuttings must be stored in cool, moist conditions such as wet newspaper, sphagnum moss, peat, or sawdust. Ideally, cuttings should be processed soon after harvest (within 2 to 3 days). If cuttings were to be sown directly outside, they could probably be stored for 2 to 3 months in moist sawdust or sphagnum in temperatures just above freezing.

PROPAGATION METHOD: Vine cuttings

PRETREATMENT USED: Fungicide (Captan/Vitavax), Hormodin #3 (IBA) rooting hormone.

METHOD OF GROWING: Attempts to root vine cuttings in a cold frame and directly in the field were unsuccessful. The age of cutting material and difficulty in controlling moisture and temperature conditions were contributing factors in their failure to root. The most successful method at Quicksand PMC was greenhouse propagation. One-year-old vine material was collected and cut into single-node pieces. The outer stem material was peeled back slightly near the base of the cutting, dipped in fungicide (Captan/Vitavax) and a rooting hormone (IBA-Hormodin #3), and stuck in flats and peat pots of 1:1:1 peat, perlite, vermiculite. Material was kept moist and warm. After material rooted, it was planted to the field. Collections made in the winter of 1993 will be rooted in the greenhouse and planted to a raised bed in the field. Estimated growth in woody beds will be one to two growing seasons, depending on the growth.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None

RE-ESTABLISHMENT TECHNIQUES: Unique techniques undetermined

CENTER NAME: Quicksand Plant Materials Center

Yucca baccata Torr.

DATIL YUCCA
SPANISH BAYONET

BRIEF DESCRIPTION OF NATIVE HABITAT: Data unavailable at date of publication.

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed

SEED MATURITY DATE: Data not available at date of publication.

NUMBER OF SEED PER POUND: Approximately 22,700 (Young and Young 1992, 358)

PERCENT GERMINATION: Undetermined. "All species germinated readily at 20 or 25° C without pretreatment" (ibid.).

EASE OF COLLECTION: Seed was obtained from a single unripe fruit, in July; the remaining fruits were eaten by rodents before ripe seed could be harvested.

METHOD OF CLEANING: Can be cleaned with air screen.

STORAGE REQUIREMENTS: Can be stored dry at room temperature

ESTIMATED PROPAGULE STORAGE POTENTIAL: One year

PROPAGATION METHOD: Untreated seed can be sown into seed flats and transplanted to growing containers after germination, or seed can be directly sown into final containers.

PRETREATMENT USED: None needed; can apply presoaking for 24 hours or mild scarification.

METHOD OF GROWING: Seedlings should be grown in deep containers with ridges that help prevent root spiraling. A well-drained growing medium should be used to help prevent root rot. Seedlings respond well to a constant fertilization program, where approximately 100 ppm nitrogen, phosphorus, and potassium are applied with each watering.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None noted.

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None noted.

RE-ESTABLISHMENT TECHNIQUES: "Seedlings are container-grown and protected from frost the first winter" (ibid.).

CENTER NAME: Los Lunas Plant Materials Center

REFERENCE: Young and Young 1992

Yucca glauca Nutt.

Y U C C A
S M A L L S O A P W E E D
B E A R G R A S S
S O A P R O O T

BRIEF DESCRIPTION OF NATIVE HABITAT: Grows best in well-drained soils, on xeric sites in open, sunny exposures. Found on upland prairies, plains, sandy blowouts, and hillsides (often in limestone soils).

TYPE OF MATERIAL COLLECTED FOR PROPAGATION: Seed, rhizomes, roots, and stems.

SEED MATURITY DATE: Seed capsules ripen from mid-July to late September.

NUMBER OF SEEDS PER POUND: Clean seeds average 22,680 per pound.

PERCENT GERMINATION: Can vary from 45%-98% depending on seed quality.

EASE OF COLLECTION: Seed capsules are dehiscent and should be collected just before or at the time capsules open. Generally picked from the plant by hand.

METHOD OF CLEANING: Seed is easily extracted when capsules are dry. Capsules can be run through a tumbler, revolving box, or drum with screen sides that allows the seeds to fall out. Chaff and other capsule material can be sifted out quite easily.

STORAGE REQUIREMENTS: Seeds have been satisfactorily stored dry at room temperature.

ESTIMATED PROPAGULE STORAGE POTENTIAL: Unknown. Probably several years under cold, dry storage regime.

PROPAGATION METHOD: Seed, stem cuttings, offset division, rhizome division, and root cuttings. Germination tests have been run at temperatures between 82°-90°F, with the majority of samples tested ranging from 80%-90%. Root cuttings, covered by four inches of soil, are effective for propagation.

PRETREATMENT USED: There is some evidence that yuccas exhibit some degree of hard-seededness. Germination periods can be reduced by soaking the seeds in water for 24 hours at room temperature, or by mechanical scarification or removal of the hard seed coat at the hilum end.

Yucca glauca

Y U C C A (cont.)

METHOD OF GROWING: Field germination usually begins in 1 to 2 weeks under optimum conditions, but may continue for 2 to 3 years due to hard seed coat. Seedlings in the field should be mulched the first winter if there is danger of frost. Seedlings are ready for transplanting during the second season.

UNUSUAL OR UNIQUE HARVESTING OR DIGGING REQUIREMENTS: None known

UNUSUAL OR UNIQUE PROCESSING REQUIREMENTS: None known

RE-ESTABLISHMENT TECHNIQUES: Few nurseries raise yucca from seed. Most landscape plants transplanted from field or vegetatively propagated.

CENTER NAME: Manhattan Plant Materials Center

REFERENCES: Alexander and Pond 1948; Barr 1983; Johnson and Nichols 1970; Kindscher 1982; Nebraska Dept. of Agriculture 1979; Runkel and Roosa 1989; Smith 1989.

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